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May 24, 1923

Engineering News-Record

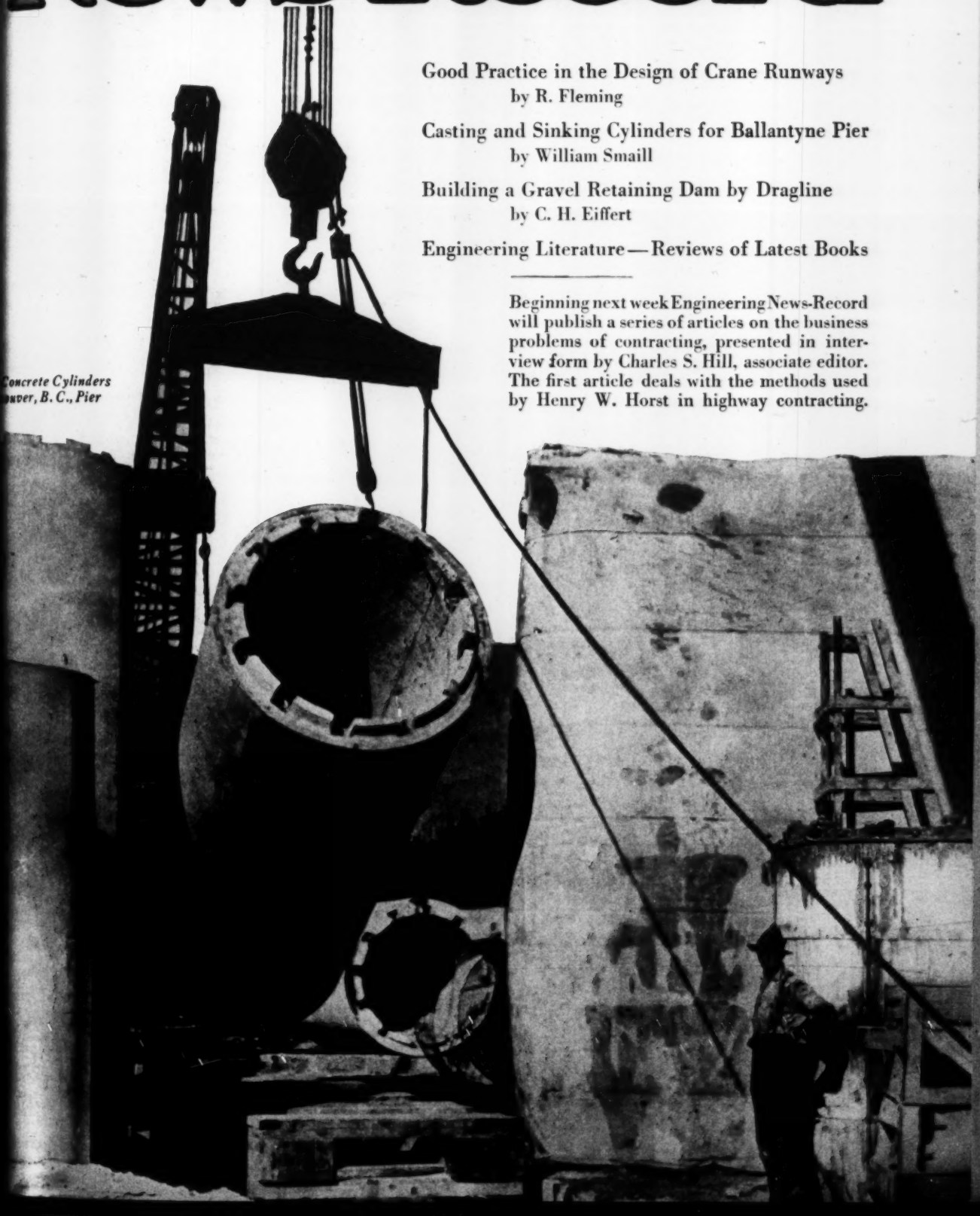
Good Practice in the Design of Crane Runways
by R. Fleming

Casting and Sinking Cylinders for Ballantyne Pier
by William Smaill

Building a Gravel Retaining Dam by Dragline
by C. H. Eiffert

Engineering Literature—Reviews of Latest Books

Beginning next week Engineering News-Record will publish a series of articles on the business problems of contracting, presented in interview form by Charles S. Hill, associate editor. The first article deals with the methods used by Henry W. Horst in highway contracting.



Concrete Cylinders
uver, B. C., Pier

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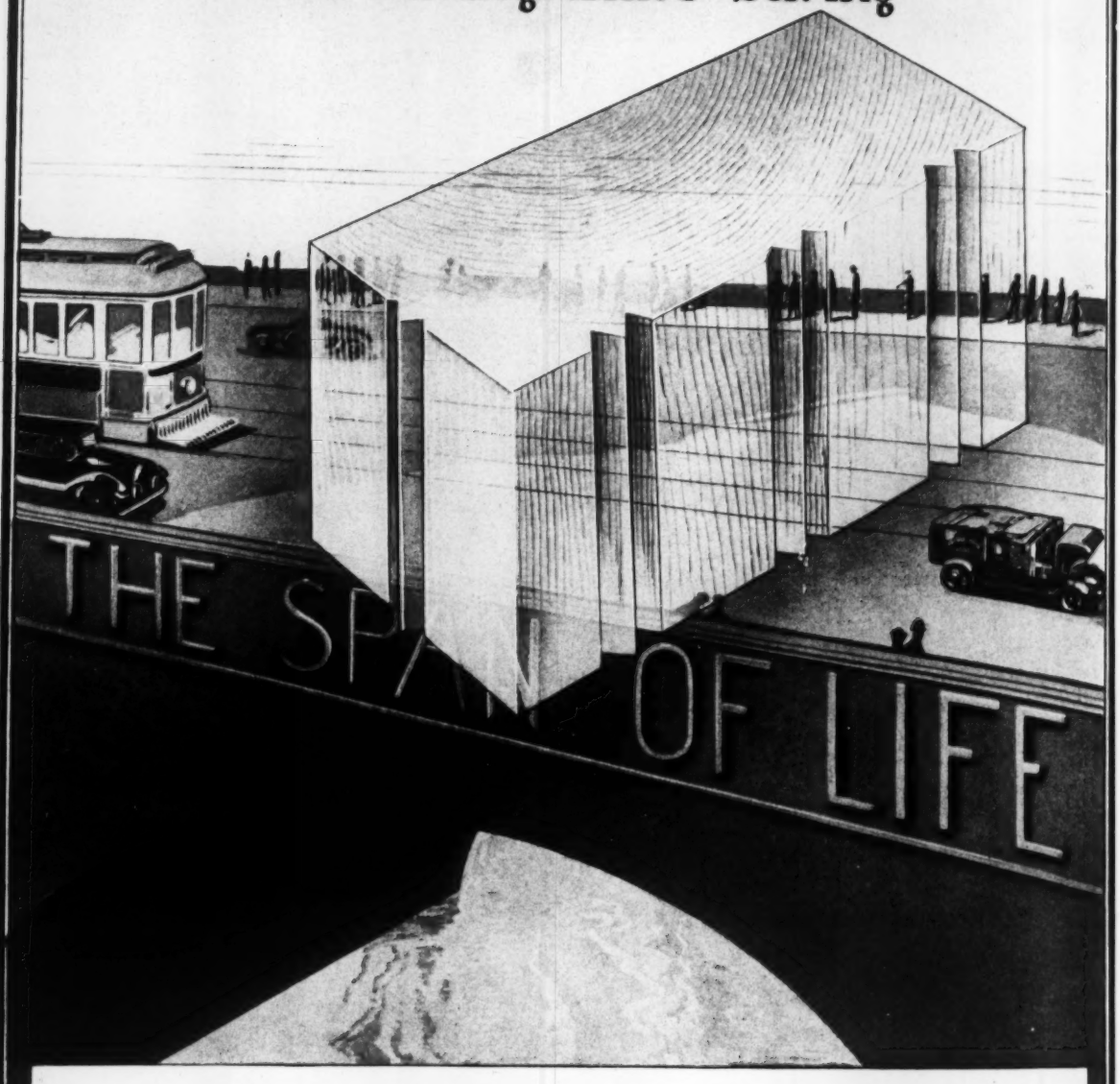

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ENGINEERING NEWS-RECORD

DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

E. J. MEHREN, Editor
FRANK C. WIGHT, Managing Editor

Volume 90 — NEW YORK, MAY 24, 1923 — Number 21

More Publicity Not More Facts

WITH the wide publicity it has received and will continue to receive the American Construction Council's admonitions regarding the building situation admirably reinforce the several similar admonitions of the past weeks. The suggestions of means whereby may be avoided an overexpansion of building with consequent evil effects not only on the building industry but upon business prosperity in general, together with the premises upon which those suggestions are based, are sound provided it is remembered that the emphasis is laid on speculative and unnecessary construction. These two types of construction, furthermore, are peculiar to the large cities and are there confined mostly to buildings of the luxury, office or housing class, of which the first two are as a rule unnecessary and the last two speculative. The desired letdown in such building has already started and the bankers and speculators who read the current economic signs will doubtless see to it that no further expansion occurs. There is, furthermore, enough business in hand that must go on so that the continued prosperity of the industry is assured. But the Construction Council's report, we believe, underestimates the extent to which this caution already pervades the business world and is somewhat confused in discussing further means of getting that world to appreciate the current situation. Publicity of the facts as to construction activity is necessary, and the council's plea for promotion of such publicity is good, but one might assume from the report that those facts are not available. That is not true. They are available and await only increased publicity. A number of agencies, among which is this journal, are collecting and distributing significant figures of construction activity, figures which are authoritative, accurate and timely. Any further service should lie in getting those figures wider distribution, and not in setting up more means of obtaining them, which would only be duplicating work already done.

A Graceful Tribute

IN WASHINGTON last Friday night to the light of many torches a decorated barge carrying two men floated slowly down the lagoon just west of the Washington Monument toward the Lincoln Memorial, at the same time a procession of distinguished citizens in pageant procession moved down the parallel banks. On the step of the marble temple an ex-President of the United States welcomed one of the men and presented him to the President of the United States, from whose hands he received the gold medal of the American Institute of Architects, a tribute to a master architect. In thus honoring Henry Bacon, the designer of the Lincoln Memorial, the architectural profession displayed one of its most engaging qualities—the ability to rise superior to the prosaic detail of the day's work into emotional expression. The Lincoln Memorial is one of the great works of American art and architecture. It is altogether right and proper that the man who conceived it should be honored in a way that will impress all who saw the ceremony or who read of it with the high degree of appreciation the work arouses in his professional fellows. It is perhaps too much to hope that engineers can forget the practicality of the things they do long enough to follow such an example. Perhaps, too, few engineering works are so exclusively the product of one man's brain as is an architectural creation. But there are engineers whose work has justified a pageant similar to that held on the banks of the Potomac and it would add a very necessary humanness to the engineering profession could they relax sufficiently to indulge in such a ceremony when the man and the structure warrant it.

A Professional Obligation

JUST now there is an opportunity to pay a belated tribute to one of the great engineers of the passing generation. Alfred Noble embodied the best characteristics of the engineer. His name is not synonymous with some single huge engineering work; his fame is not that of Goethals or Eads. But through the last quarter century of his life he pursued a calm, judicial way, the sought advisor on many enterprises. Integrity, ability and judgment were his in full measure. The American Society of Civil Engineers at the outbreak of the Great War planned a memorial for him at Washington which not only should honor him but through him honor the engineering profession at the capital. The strenuous years since 1914 have held up the project but now the committee comes before the profession with a request for funds—for $100,000—with which to carry out the plan. An obligation rests on the profession which it must not fail to satisfy.

Safeguarding Water Supplies First

CONCENTRATION on activities designed to insure safe public water supplies was an outstanding feature of the state sanitary engineers' conference held at Washington last week. The multiplicity of details considered and the many problems necessarily left to future consideration for lack of sufficient data illustrate how important this branch of the duties of the engineering divisions of state health departments has become. It is a noteworthy fact that with the growth of these engineering divisions state health department activities have been directed more and more to water supplies, whereas in the earlier years the chief drive in most states was to compel cities to build sewage-works. Under that drive our municipalities were compelled to pour out money for plants that would have had no appreciable effect on public health if they had been properly operated, and which in the majority of cases have been poorly operated. The state sanitary engineers and engineers in private practice have at last

brought many if not most of the state departments of health and many city officials to see that water supplies should receive first attention, and that the chief function of sewage-works is to prevent the overloading of our streams beyond their power of dilution and oxidation, and, where public water supplies are affected, that sewage treatment should be regarded as a means of preventing the overloading of water-purification plants, all of which are real safeguards against water contamination.

The Phenol Water Menace

IN COLLECTING data and calling last week's conference on water contamination by phenol wastes the Public Health Service has wrought well. When the extensive data and opinion summarized elsewhere in this issue are printed by the Public Health Service, as presumably they will be, the exhibit will be surprising and perplexing as well as eminently useful. It will doubtless serve to stimulate action to keep these wastes out of streams and lakes used for public water supplies, either by diversion or by treatment. Co-operation with the producers of the wastes should be the first effort because their industry is of great economic importance and because many data must yet be collected and principles established before the phenol problems as related to water supplies—chemical, health and legal—can be solved.

The Job Ahead in Road Building

FACTS and figures made public at last week's annual meeting of the American Road Builders' Association by Thomas H. MacDonald, chief of the U. S. Bureau of Public Roads, should remove any misgivings regarding the need for a large scale national road-building program continued over a number of years. Few people have any real conception of the task ahead in highway development. At present the yearly outlay by the federal government, states, counties and townships bulks large when considered by itself. Viewed in the light of the ultimate job of providing the United States with adequate highway transport facilities, however, the yearly budgets of today, running close to a billion dollars for rural highways—and this figure excludes paving work within city limits—shrink to modest proportions.

The nation's total rural highway mileage is about 2,800,000, of which approximately 180,000 miles have been included in the 7 per cent federal-aid system specified in the Highway Act of 1921. Citing the fact that since 1916 about 25,000 miles of the federal-aid highway system had been completed, Mr. MacDonald seems to have ample justification for his statement that "we haven't even started to build highways in this country." Coming from the highest ranking road official in the country this estimate of the situation is significant, and it becomes doubly so when reinforced by results of a new and comprehensive statistical survey of expenditures for rural highways throughout the country, completed recently by the Bureau of Public Roads, showing a total for all purposes, outside of cities, of $970,000,000 during the year 1921. Previous incomplete estimates placed this figure at a considerably lower level—about $600,000,000. The later and more accurate information, therefore, shows that the previous yearly estimates which were considered in some quarters as extravagant were, in reality, conservative. If the nation is ever to catch up with the demands of its highway traffic an expansion, rather than a contraction, of the road-building program must occur. And, as the new construction is completed year by year, the mileage that must be maintained also will grow, a situation which led Mr. MacDonald to say: "I do not see any end to the road-building program."

Some objectors to the large expenditures being made on the federal-aid system labor under the mistake of assuming that the construction is all of the costly heavy-traffic type. As a matter of fact, the Bureau's figures show that only 26.8 per cent of the federal-aid construction thus far completed comes within the foregoing classification, and effective answer to the charge that the new system discriminates against the local road user. The further fact is brought out that in a state like Indiana, for example, 99 per cent of the total population is included in belts 5 miles wide on each side of the federal-aid system.

The question today is not whether we need the roads but whether we can get them built. In roads, as in practically all other forms of construction, we are far behind our needs but we must face the fact that our construction capacity, either in men or materials, is grievously below our needs. It will be necessary, therefore, to apply to our road program the same restraint as is being applied to other construction. The criterion for any proposed road must be the relative ease of getting the men and the material without disrupting the market in either. Fortunately, as the above figures show, the larger part of our proposed roads are local enterprises, imposing no great load on transportation systems, material producers or the national supply of labor. Such roadbuilding must go on, subject only to the restrictive elements in the local labor and material situation. As for the heavy traffic trunk roads, necessity is the major criterion, just as it is in buildings. The thing to remember is that all figures are relative and that a billion dollars a year is not too much to spend in this year of increased production capacity, when the country readily absorbed nearly that much in the low-production year of 1921.

One more point needs emphasis: Less than one-half of the billion-dollar-a-year program is being spent under the control of federal and state agencies. It is clear, therefore, that one of the most pressing problems is the development of local organizations with business and technical personnel qualified to direct the economical expenditure of large sums and to design and construct roads adequate for the needs they are intended to serve.

Lake Rivers as Harbors

THE harbor cities of the Great Lakes confront a genuine problem of public and private business administration in the question of whether the little rivers that flow through them and cut apart their business territory should now be closed to the relatively small amount of navigation surviving from the important water traffic of pioneer days. The question has been discussed in Milwaukee, in Chicago, and in Cleveland, and in all three cities the situation is of equal intricacy, nothwithstanding the differences in local conditions. Some years ago Milwaukee engineers recommended that their river be closed to navigation. In Chicago, old proposals to the same effect have recently been revived on the basis of a rather fantastic project to roof over the river by a continuous bridge which would form a boulevard through the city.

Decision of the question can only be approached properly on the basis of a comprehensive and thorough-

going study of all elements of the problem, such as was suggested in a letter which we printed from Robert Isham Randolph in our issue of April 12. Of necessity it must be a combined engineering, business, and city planning study. We hope that in at least one of the three cities mentioned such a study will be initiated soon.

But it is important, in approaching a study of this kind, to cast off all ballast of false premise or extraneous consideration. Such premises and complications injected themselves into the letter referred to, and they indicate at once the difficulty or even impossibility of arriving at a sound conclusion unless they are eliminated.

Basic to the problem in all three cities is the fact that the river—whether the Milwaukee, the Chicago, or the Cuyahoga—is a most unsatisfactory and inefficient navigation channel for ships. Narrow, tortuous, and crossed by many busy bridges, it constitutes a terminal approach so defective in its operating characteristics that no transportation man responsible for the expeditious and economical carrying of traffic would tolerate it. The resulting traffic difficulties are felt both by the traffic itself and by the city through which it moves: the traffic movement is slow, dangerous, and uneconomical, while the city is under the double disadvantage of having to bear the undue cost of this traffic and of providing for the expense and losses imposed upon land traffic which must cross the waterway. What these latter costs amount to has never yet been computed, but some idea of their magnitude may be formed from the fact that the single item of operating and maintaining the Chicago movable bridges costs a million dollars annually—fixed charges not included—while it has been stated that the delays to railway traffic alone, caused by the bridges, exceed the total value of the river navigation.

A second basic condition is that all three cities have ample water frontage on the lake shore, far more extensive, accessible, and convenient to the various parts of the city to be served than the river frontage. All three, moreover, have made beginnings toward developing that frontage for shipping terminal use. The movement was strong in Cleveland half a dozen years ago, and in Chicago has gone at least to the point of the construction of a municipal pier, while Milwaukee has developed an elaborate paper plan for a lake harbor development.

Adding the further fact that lake commerce has decreased and changed in type and the fact that practically all the river front property is in private ownership, a sketch of the underlying conditions is obtained.

Of the derived factors of the case, the main one is that railroads and manufacturing and storage industries are massed along the river banks, and that the plan of development of the city is essentially built upon the the basis of the zones of storage, milling, supply, and wholesaling which parallel the banks. The result is that the river effectually cuts apart the city in a harmful way. In Cleveland, where the river flows in a broad valley, the separation is more readily apparent, but Milwaukee and Chicago have in fact the same territorial separation due to the stream itself and the zoning which follows the stream. And in Chicago this zoning girdles the downtown business district as disastrously as does the Union Loop.

With such difficult fundamental conditions to face as have been indicated above, it is only begging the question at the very outset to inject into the discussion such phrases as "paramount public right" and "infringement upon private riparian rights." These rights, such as they are or may be found to be, do not constitute a reason against a river-closing plan except in the cost of purchase or condemnation of property that they might necessitate. The word "paramount," with its ever present suggestion that it is a clincher, is particularly mischievous in this connection.

Equally necessary is it to avoid introducing false or specious considerations. Our correspondent mentioned the federal investment in improvements to the Chicago River for navigation, referring presumably to government *expenditures* and ignoring the fact that an irrecoverable expenditure is an investment only when it pays dividends or at least earns its keep. He referred similarly to investment of the Sanitary District for purposes of navigation and sanitation, an item whose bearing on the matter is questionable in the same sense. He dragged in by the ears the absurd argument that river closure might impede the flow of water and might cause sedimentation which could not be removed. He threw the cost of the Chicago municipal pier into the scale as an argument against river closure—as though this pier, which is on the lake front, would lose rather than gain from making the lake the city's harbor!

But beyond all this, our correspondent removed the case from all discussion in picturing the coming of a busy barge business from the lakes to the gulf through the heart of Chicago with the richly scented Chicago River as its Grand Canal. The very question at issue is whether Chicago can afford to remain a group of scattered communities stringing along the banks of a steamer route or a barge towpath, or whether it can no longer continue to afford this—the same question precisely, in slightly different terms, that concerns Milwaukee and Cleveland. This is the overshadowing question, and whenever it is made secondary to other desires and ambitions, the friends of progress in the Lake cities will be ill served.

But progress in these matters is on the way. Even our correspondent, despite his preoccupation with the possible needs of the Chicago River highway to the ocean, pleads for elimination of the drawbridges and for the universal adoption of fixed bridges across the river. With this approach, we are nearer facing the question of who in the last analysis is entitled to exercise control over the navigation of such a stream—the federal government or the community which the stream serves. Once the principle can be established that the manner of use of the Chicago River is within control of the city of Chicago itself, that the city may decide what type of vessels, if any, is to be excluded, and what restrictions shall govern shipping, it will have a free path to declaring the river a waterway for small vessels only, to levying a river tax to cover the undoubted expense to the city in operating the cross-river traffic, to attaining effective control by acquisition of river-front property, and the like. A course toward a solution, in other words, is open so long as progress has gone to the point where partial closure to navigation is conceded and demanded. We have every faith in the willingness of the federal government to support the conclusions of the local authorities, in the case of Chicago at least, when once the local authorities take hold of the question determinedly and purposefully.

Casting and Sinking Cylinders for Ballantyne Pier

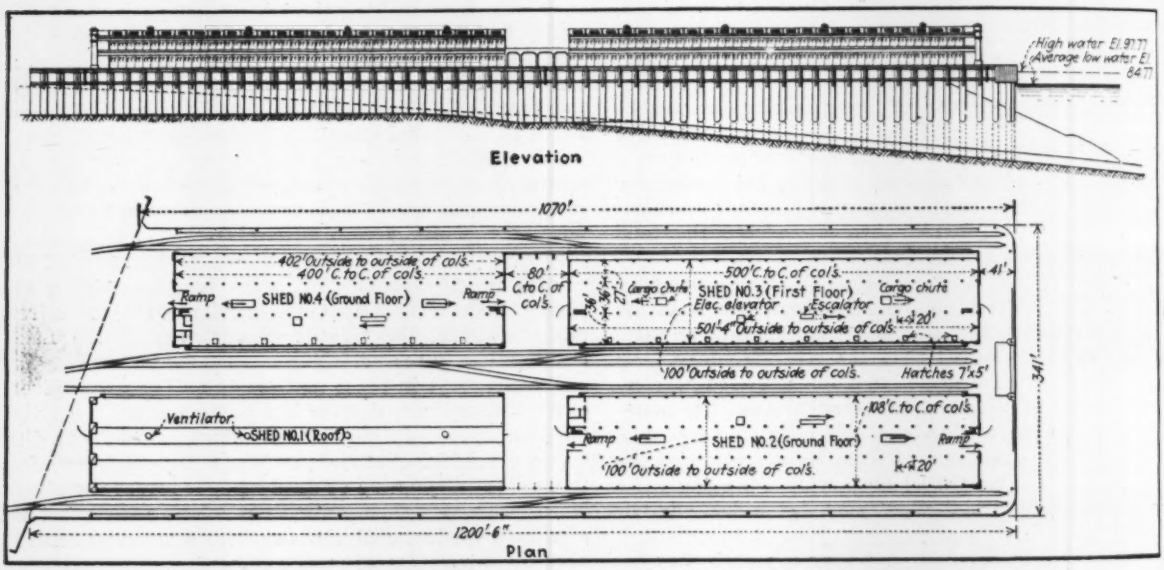
New Shipping Pier at Vancouver, British Columbia, Is of Reinforced-Concrete Framework Founded on Heavy Precast Cylinders—Details of Construction of Foundations

By William Smaill
Chief Engineer, Northern Construction Co., Vancouver, B. C.

THERE is now nearing completion in Vancouver harbor, British Columbia, a large and rather complicated shipping pier, the substructure of which is made up of precast concrete cylinder piers, tied together with precast concrete beams and trusses. The details of the construction and erection of these piers and their connections are the subject of this article.

In May, 1913, the federal government at Ottawa placed the harbor under the control of a Harbor Commissioner, consisting of a president and two commissioners. In 1918 A. D. Swan, consulting harbor engineer, of Montreal, was engaged to make a report on the needs of the harbor and recommendations for its development.

The first undertaking by the commissioners towards the development of the port was the construction of a pier designed by A. D. Swan, and known as the "Ballantyne Pier." This structure is of reinforced concrete throughout. It has a length of 1205 ft. from the shore quay, and a width over all of 341 ft.

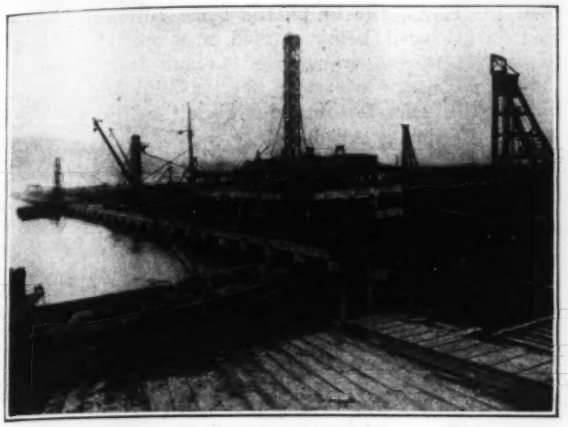


PLAN AND ELEVATION OF BALLANTYNE PIER, VANCOUVER HARBOR

The first contract on the work called for the dredging of the berths on each side (the inner berths have 35 ft. of water at low tide and the outer berths 45 ft.), and the gravel and sand fill forming the heart of the pier and the shore quay embankment. This was let to Grant & MacDonald, dredging contractors, in September, 1920, and completed in November, 1921. Contract No. 2, for the construction of reinforced-concrete pier and transit sheds, was let to the Northern Construction Co., Ltd., & Gen. J. W. Stewart.

Details of Substructure—In the construction of the substructure Mr. Swan's design calls for all portions of the pier which are subjected to the action of the salt water to be precast, so that a careful inspection could be made and the sections well seasoned before being placed in the salt water. It might be noted here that the waters of Vancouver harbor are generally much less saline than the Pacific, being largely diluted by the fresh water from the Fraser River and other smaller streams running into it, and that structures in the harbor are not subjected to any severe freezing conditions. It will be seen from the illustrations that the deck is supported on solid concrete cylinders 7 ft. in diameter which are all sunk to rock. The columns are braced horizontally by means of the lower and upper concrete fender beams, and across the structure by the concrete trusses, the top of the latter being tied into the main heavy concrete girders that are part of the deck proper. The main deck, girders, beams and upper fender beams, being out of the water entirely, are cast in place, the whole being reinforced, and are tied into the trusses and upper sections of bearing columns. This deck is designed to carry a load of 750 lb. per sq.ft. Around the inner section of the deck, to retain the gravel fill in the heart of the pier there is driven a row of 18 x 12 in. x 35 ft. reinforced-concrete sheet piles, supported by concrete bearing beams that are tied into the upper portion of the inner row of concrete cylinders.

The structure as a whole gains an additional stability supplied by the gravel and sand fill in the center of the pier, and all but the outer row of cylinders are sunk through portions of this fill to rock. On the main deck there are four two-story reinforced-concrete transit sheds with a gross floor area of 394,500 sq.ft. All doors are steel and windows wire glass. The sur-



BALLANTYNE PIER, VANCOUVER, IN COURSE OF CONSTRUCTION
Substructure all in, reinforced-concrete framework superstructure being built.

face of the pier is paved for vehicular traffic and sheds can be entered from either end. On the deck proper and to serve the sheds and vessels there is about 8,000 ft. of track. It is the intention to have the pier and sheds equipped with latest facilities in the way of electrically operated cranes, cargo hoists, escalators, trucks, etc. For the speedy and safe handling of cargoes, the pier and sheds are to be exceptionally well illuminated for night work. The total cost of pier and equipment will be about $6,000,000.

Casting Plant—The first work to be done on this contract (No. 2) was to start the manufacture of the precast units. Owing to these units having to be seasoned for at least 60 days after pouring a large amount of storage room was required and to obtain this the nearest practical site that could be acquired was at North Vancouver, two and one half miles across the harbor from the site of the pier, on what is known as the Fell Fill. This is a level fill about 30 acres in extent made up of fine sand pumped in between bulkheads and having a landing pier at one corner to deep water; the whole was well suited for the purpose. The general layout of the yard is shown on the plan.

Along the south wall of the fill where the mixing plant was stationed (gravel, sand and cement are all delivered by water), there not being sufficient water at low tide to float sand and gravel scows, timber grids were constructed along this wall so the scows could be placed in position on high tide and have safe landing on grids in low water and a short pile pier was constructed between these grids to deeper water for the cement boats to land. The materials from the scows are handled by means of a traveling timber gantry crane, operating a 1-yd. clamshell bucket delivering the sand and gravel either direct to bins over the mixer or to storage piles on either side. The cement boat ties up to the small pier, delivers the cement on the pier in slings, the slings in turn being handled by the gantry crane and dropped in place through hatches in the roof of the cement shed direct to piles on the floor which is level with the charging hopper of the mixer.

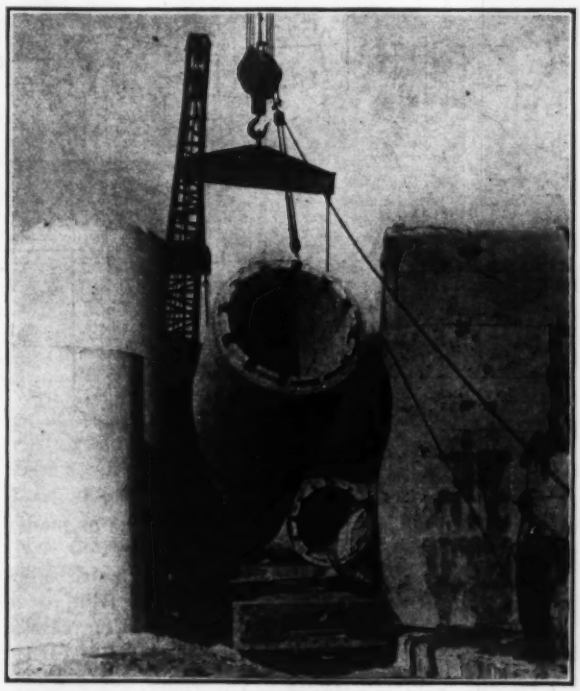
The mixing plant has overhead bins, discharging into measuring boxes which in turn discharge into the hopper of a 1-yd. mixer which is set high enough to discharge into 1-yd. buckets on cars. The cement shed is at the rear of the mixer and the floor on same level as charging hoppers of mixer.

The sand and gravel used are all fresh water washed and carefully screened and graded, the largest size gravel is what passes through a 1½-in. ring. Each scow of gravel and sand is tested to see if the proportions are correct.

In front of the mixer, a 25-ton stiff-leg derrick with a 60-ft. boom is set up, the engine being controlled from a lever house set high enough to give operator full view of the hook at all times. This derrick handles the concrete direct from the mixer to the cylinder forms, sets up and takes down steel forms, steel cages and reinforcing bolts, steaming tarpaulins, raises and turns concrete cylinders, and loads them on cars for removal to the skidways.

The forms for the cylinders, concreting buckets and turning bar for cylinders are designs and patents of the Lock Joint Pipe Co., and this company was given the privilege to purchase and use these forms.

In front of the 25-ton derrick and in the same radius boom reach from mixer discharge, a concrete casting platform is built in which steam pipes and jets are

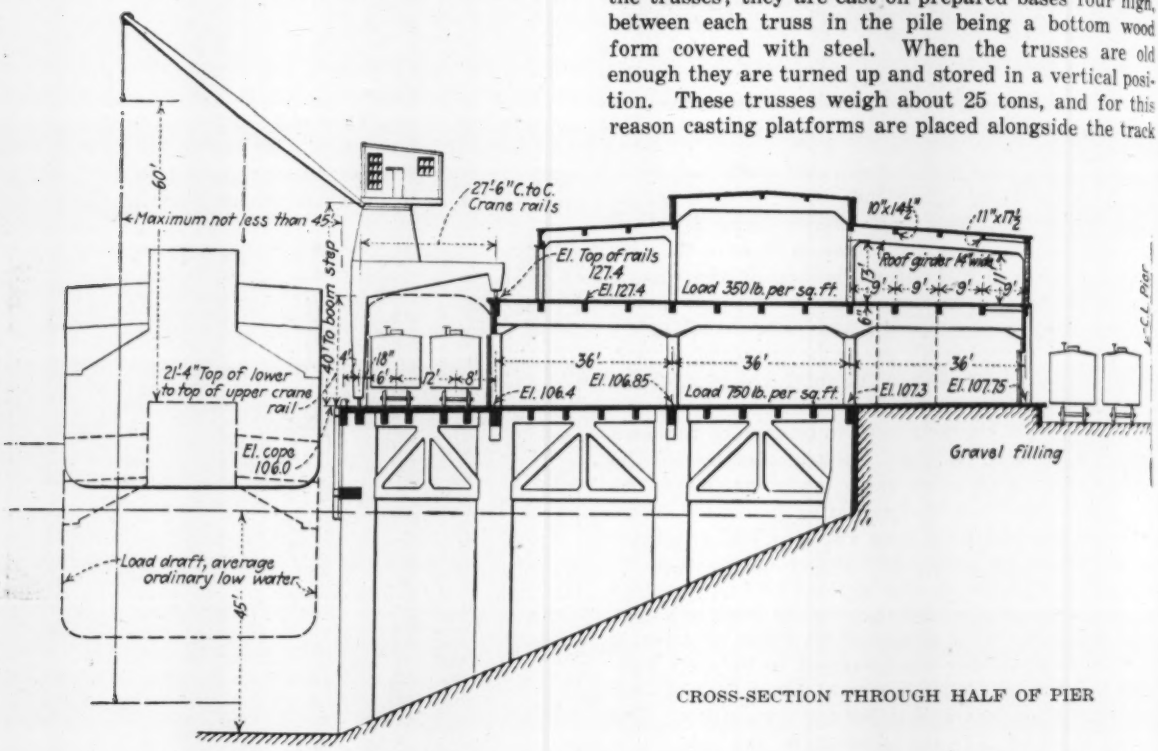


TURNING SECTION OF CYLINDER PIER

cemented in their proper spacing. The cast-iron bases are first set up in their exact location. These bases are shaped to support the inside and outside forms of shell, support the steel cages, space and center accurately the tying and reinforcing bolts, and shape the bell end of the cylinder. The inside form is first set in place, then reinforcement, outside forms, and last the top ring—this top ring supports the upper ends of bolts in position and shapes the spigot end of the cylinder. The concrete is placed in cylinders by means of a 1-yd. cone-shaped bottom discharge bucket.

Casting the Cylinders—A great number of experiments were made in the placing of the concrete in these shells to get a dense mass with a good skin. The method giving the best average results was to use a couple of small air hammers on the outer steel shell while pouring. This necessitated a good deal of strengthening of the steel forms to stand the vibration. The hammers only have to be used on the outside, the vibration being carried through the mass to the inside. The surface of both sides on stripping forms is generally as near perfect as it is possible to make it by any means.

A suggestion was made to try and agitate the forms with a high speed vibrating screen motor attached to them, but as the air hammers were working so well, it was thought best not to spend any more time or money on experiments.



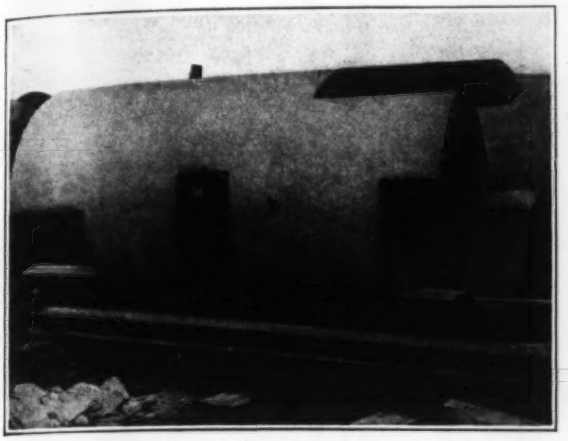
CROSS-SECTION THROUGH HALF OF PIER

The cylinders, of which there are nearly five miles in the pier, are cast in varying lengths from 4 to 17½ ft. long. After the forms are filled, a canvas tarpaulin is placed over the forms and steam is turned on, at each cylinder. There is one inside and one outside steam jet. This steaming time varies with the outside temperature but rarely runs over 10 hours. Next day forms are removed and the following day the cylinder is picked up carefully, turned, placed on a car, which is on depressed track with top of car level with skidways, taken out to skidways in the storing yard and rolled off into place to cure. Precast units have generally been over three months old before being placed in the pier. The concreting of the cylinders starts in the morning and is through by noon; this crew then goes on in the afternoon casting the different precast units. Another shift comes on at 1 p.m. and works until 9 p.m. They strip the cylinder forms, set up new forms, turn and yard the pipe and get everything ready for next day's pour of cylinders.

In concreting the units, the same bottom discharge buckets are used, being carried on a special car made to hold them and transported to and from mixer by a 6-ton gas dinkey to one of the traveling cranes which handles the concrete into place while the dinkey is away for another load. All units are cast on platforms, surfaced with sheet iron, sectional wood forms lined with steel being used. The exposed face of the unit after casting is given a hard trowel finish; in this way all precast units have a smooth dense skin on all surfaces. The side forms are generally removed the next day but the units remain in place on the platform until with specially devised hooks, slings, etc., it is thought safe to remove them by means of a locomotive crane, to special storage piles. This holds true for all except the trusses; they are cast on prepared bases four high, between each truss in the pile being a bottom wood form covered with steel. When the trusses are old enough they are turned up and stored in a vertical position. These trusses weigh about 25 tons, and for this reason casting platforms are placed alongside the track of a traveling 30-ton gantry crane, which track runs along the easterly portion of the yard to the deep water loading stage. In this way the heavy trusses have only one handling, as they are picked up with a 30-ton gantry and carried direct down the track to where they are loaded on scows; the other units are loaded onto cars by the locomotive crane and transported to this loading point by gas dinkey where they are handled to the scow with the gantry. Special slings have been devised for the handling and loading of the different types.

The reinforcing steel which comes in cars is stored at the opposite end of the yard to the mixer. A large motor driven bar bender is used for bending all steel with the exception of stirrups and hoops, the stirrups being bent with a special machine devised by ourselves for the purpose and the hoops in a small set of rolls. The unit reinforcement is generally assembled in platforms or frames set accessible and at proper working height; after fabrication they are handled to the forms by means of locomotive cranes.

The cages and hoops are made in small rolls. They

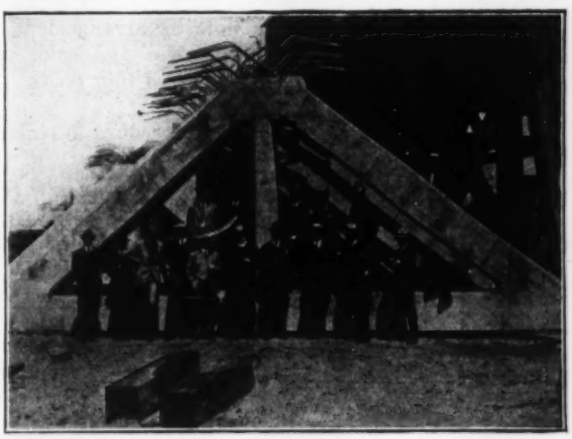


UPPER SECTION OF CYLINDERS
Shows recesses for ends of trusses and bearing beams that support sheet piles, deck beams and girders.

are then placed on a form which sets the proper circle, and the lapped ends are tied. These hoops are then placed in a spacing frame for tying the straight rods in place, Instead of using a lot of individual wires at each joint the No. 16 wire is wound spool fashion, on a short stick, and starting at one end of the rod the wire is wound spirally tight around the rod. Whenever a joint between the hooping and straight rod is reached the hoop is carefully spaced and the wire is wound in both directions around the joint and the winding continued on down the rod to the next joint; in this manner every joint is tied and tied well. Two diagonals of No. 3 wire are placed on opposite sides of the cages and the ends fastened into the cage, a twister is placed in the center of each pair of diagonals and brought up tight. This completes the job of making a rigid cage of reinforcement for the cylinders.

For the supporting of all the unit reinforcement in the forms, the engineers were very anxious not to use steel chairs that might in time rust and carry rust into the reinforcement and blocks and perhaps leave planes not watertight that would be harmful later. Naturally, sky hooks were the first thing thought of and eventually a system of temporary support of all the reinforcement on the job was used hanging the steel up on hooks until forms were filled, when they are removed.

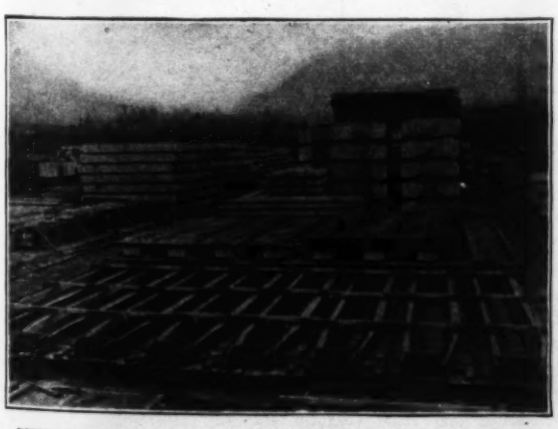
Erection of Substructure—When the piling of the shore quay embankment and heart of the pier was being completed, a central concreting plant similar to the one at the casting yard at North Vancouver was erected on the shore line west of the pier with landing grids. The steel yard and shed was situated on the east side of the pier and a standard-gage track placed for use of locomotive crane, 3-ft. gage being used for concrete tracks. Everything depended on the ability to sink cylinders vertically and in exact locations and the time of the completion of the pier depended on the speed with which the cylinders could be set, sunk and filled. There were many preliminary studies made to devise a quick, safe and economical way of doing this work. It was finally decided to use a cylinder driver similar to what had proven successful in use for the handling of large steel cylinders in San Francisco harbor. Drivers were designed and built to carry the heavier concrete shells, and were used on falsework instead of on scows. Although the location of the pier is not subjected to much wind, wave and current, a floating plant, especially in tidal waters, requires constant care and watchfulness. The falsework in this case besides



ONE OF THE MAIN TRUSSES—WEIGHT 26 TONS

acting as a working platform for the cylinder drivers supported the tracks for transporting the concrete in filling cylinders, carried the derricks large and small used in cylinder filling, placing of trusses and setting upper sections of cylinders. Later on, it acted as support for the formwork used in constructing the main deck.

It took a great deal more falsework than was estimated for the reason that when the time came to pull out of the piling the falsework that might have been used again, teredos had got there first. In this harbor they apparently start their work as soon as the hammer is off the pile. The piling is capped with 14 x 16-in. fir and braced with 4 x 12-in. plank running down to low water level, iron bark or Australian gum shoes are used on skids of drivers, skid derricks, etc., and greasers of same material spiked on to the caps of falsework, the latter being moved ahead and used as often as possible. It was somewhat problematical just what would happen where the piling was only driven about 20 ft. in the fill with the cutting edge of the cylinders passing within a couple of feet of the point of the pile and in places going on down through 30 ft. or more fill before hitting any firm material. It was found in practice that as long as a good load was kept on the piles, such as the weight of the cylinder drivers,

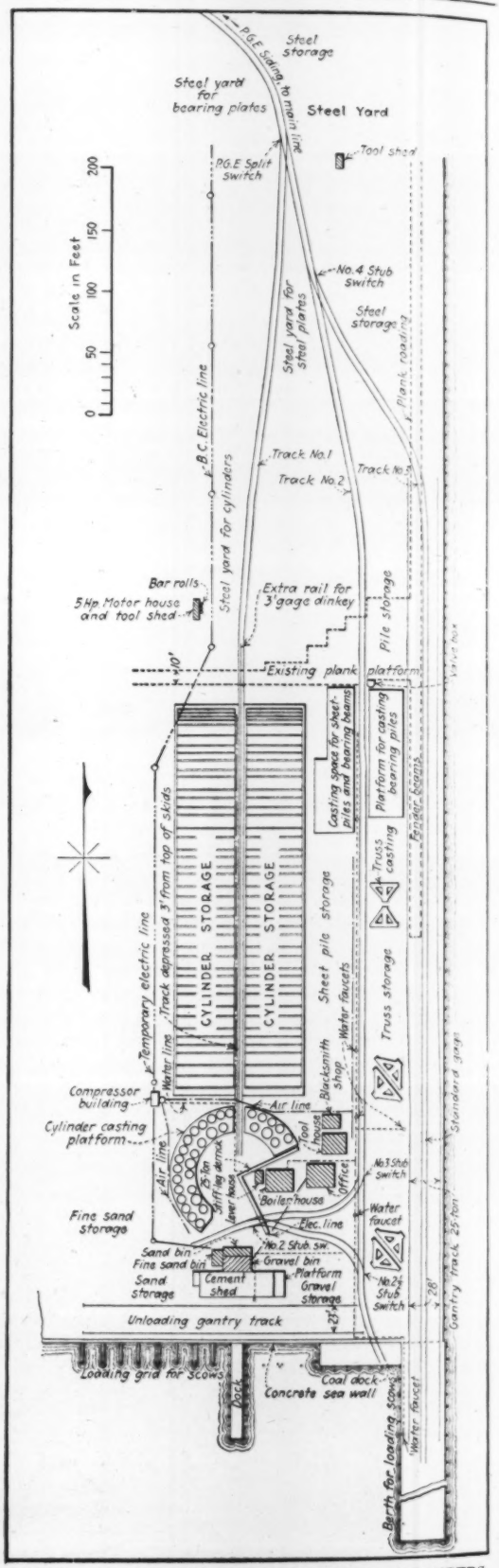


SHEET PILE CASTING PLATFORM, BALLANTYNE PIER
Fender beams at left background, bearing beams at right background. Reinforcement for sheet piles in center held by hooks from sticks laid across the forms.

the piles would not settle, but if there was no load on a pile near the cylinders, the piles would settle when the cutting edge of the cylinder got below the pile, at times pulling the ¾-in. drift bolt through the cap. So in order to stop this, piling was only driven ahead as required to support the drivers.

When a section of falsework had been driven, the erection of these drivers was started. These drivers are much like an immense piledriver; the gins are 18 x 20-in. sticks set 8 ft. apart and 70 ft. long. The head block is composed of six 24 x 24-in. timbers, and the skids are 18 x 34 in., with hog rods 2½ in. thick. The engine is a 10 x 12-in. double-cylinder three-drum. One drum carried the load line handling the cylinders, the other two operate the orange-peel bucket used in excavating from inside of cylinders, handling water jets, hydraulic jack, etc. In the center of the head block of these drivers there is a 3½-in. U-bolt; to this U-bolt is fastened a six-sheave block, capacity 80 tons. The lines rove to another similar block attached to the center of a heavy block plate and channel spreader bar, at each end of this bar is suspended a 1½-in. cable about 40 ft. long. The end of each cable is attached to the opposite sides of the working arrangement of a collapsible steel band that encircles and holds the string of cylinders while being lowered into place.

Sinking Cylinders—The general procedure in sinking cylinders is as follows: The approximate depth of the cylinder being known (the tops are all at El. +89 just above low water), a number of lengths are loaded on a scow in the longest lengths that can be used to make this depth and have the upper end of the cylinder out of low water when sinking is completed. The derrick boat removes the first section (a cutting edge), sets it on the extreme forward end of its deck and sets itself so that the cylinder will be centered in front of the gins of the driver. The collapsible band is placed over the cylinder near the upper end, the 1½-in. cables from spreader bar fastened to it, band tightened and cylinder hoisted into place in gins, then lowered so the upper end is a little out of water. The derrick boat takes the next length of cylinder and places it on top of first section in the leads, the waterproof jointing is finished and the two sections bolted tightly together. This operation is continued until a sufficient amount of cylinders have been placed in the leads until the cutting edge rests on the bottom under water. The cylinder is then carefully centered by means of short guide blocks in the gins and back frame of driver; the lowering tackle is lowered free and excavating with the heavy orange-peel bucket started. The sinking process is continued in this manner until the top of cylinder is almost to high water line, when other required lengths are placed. When these lengths are all in place an added 17-ft. length is placed without the joint being waterproofed. Its function is to give increased weight to aid in the sinking and to have the material from the orange-peel bucket discharged free of the cylinder (for use of interior bucket again); one could not be sure of this if the top of cylinder was under water. When the cylinder is finally founded, a driver is sent down to clean up, and then an inspection is made by the engineer so every cylinder has at least two final inspections before sealing. When the foundation is found O.K. a rich concrete (generally 6 or 7 yd.) is placed in the bottom of the cylinders. At the next low tide the



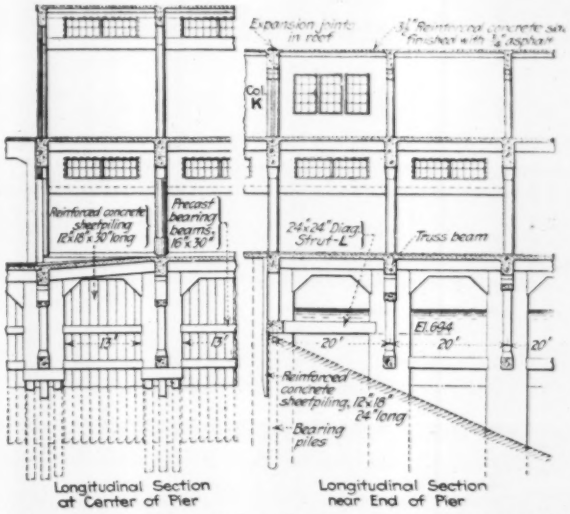
LAYOUT OF CASTING YARD FOR PILES, CYLINDERS AND TRUSSES

weight section is unbolted, taken out of the gins and the driver moved to the setting of another cylinder.

After the concrete seal has set for several days a cylinder wooden cofferdam reaching from below low water to above high water is placed on the top of the cylinder, the joint made tight and water pumped out of the cylinder by means of a hydraulic jack. Then men are lowered in a small caisson bucket to remove from the top of the seal all laitance and dirt, clean the inside walls of cylinder, bolt pockets, etc. When all is thoroughly cleaned up, the cylinder is filled (in the dry) up to El. +86 with 1:3:6 concrete using aggregate from 2½ in. down. If the top of the cylinder shell is above El. +89, it is cut off at this elevation and lean fill used between the fill at El. +86 to El. +89. Should the top of the cylinder shell be below El. +89 the richer fill is simply brought up to this point inside the coffer, the latter acting as the form. The cofferdam is left on in either case for at least five days before being removed. When the coffers are removed and concrete of top of cylinders set, the next operation is the setting of the trusses in their proper location on top of the filled cylinders and fender beams.

When these are placed, the upper sections of cylinder shells are placed in position, the joints made tight, and they are filled with concrete up to the opening in them for the deck girders. When this is done this section is ready for the setting of the main deck forms. Theoretically the above statement gives the way the cylinders ought to sink, but practically they rarely do so. What happens is that good progress is made through the placed fill, then are encountered several feet of tough hardpan containing in places a great number of boulders and below this a soft sand rock and finally a hard dense conglomeration. It is found that even small charges of dynamite could not be used in the cylinders without causing cracks, the only solution being the use of high power water jets for this purpose. There are installed two 5-stage 10-in. pumps and one 12-in. 5 stage with a motor capacity of 1,000 hp. These pumps handle the hydraulic jacks as well as the jets. A main is placed in the fill down the center of the pier with valves and branches at different points, pressure used being about 175 to 180 lb.

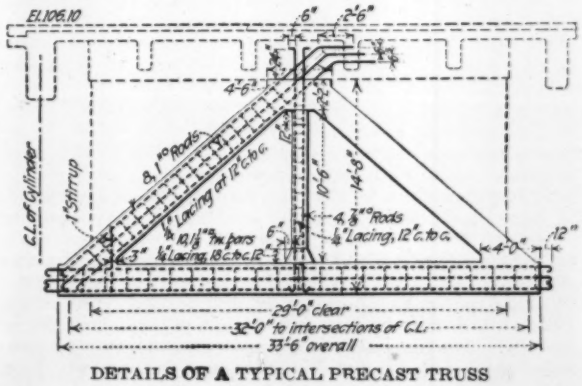
Difficulties in Sinking—When the material gets too hard for any further progress with the orange peel, it is removed and the jets attached to the lines and worked until a foot or so of material has been loosened, when the bucket is used to clean this up, then the jets are used again. Where boulders are encountered jets are used to work around them and if they are too large for the bucket to handle, a diver is sent down and with a small drill drills a couple of holes in opposite sides of the boulder, places pins with rings on in the holes and running chain to the rings, attached to hoisting tackle. Sometimes they come and other times they will not; if they cannot get power enough to pull them the only thing to do is keep working the jets a few shifts until they do. In this way boulders have been raised that would barely pass up through the cylinders, but the real fun is when one gets a good sized boulder under the cutting edge with more of it out than in and the cylinder in the fill 30 ft. or more. This means long shifts of work with divers. If enough hoisting equipment can be hooked into the cylinder to raise it, a charge is placed in the boulder, cylinder is raised, the shot fired, and sinking started over again.



LONGITUDINAL SECTIONS SHOWING PRECAST MEMBERS

It was soon found out that on account of these difficulties the estimated plant would never get the job done in time, so work was started at once on two more drivers and the construction of a 10-ton skid derrick to go with each driver. The job was rearranged, a continuous set of falsework was driven along the west bank of the fill for the heart of the pier out to the first row of cylinders to be sunk. Each driver was so located that it had a number of cylinders to work on and all drivers working away from one another and each driver given a skid derrick, the idea being that the large driver was necessary for the setting of the cylinders. When the cylinders were set and down to the point where these obstructions were generally met, it might be tied up on one cylinder for weeks, but the smaller rig could handle jets, buckets, weights, etc., at the same time it could be spotted so that while driver might be working in one cylinder, the derrick could be doing something towards keeping the sinking going in the adjacent one.

There are certain depths in fill at which the weight of the cylinder is not sufficient (with the interior excavated) to sink of its own weight. Then weight is added in the form of cast-iron rings that fit on top of the cylinder shell and these can be piled on top of one another until there is sufficient weight. The skin friction in the gravel and sand fill averages about 500 lb. per square foot; 250 tons is the heaviest weight put on a shell yet.



DETAILS OF A TYPICAL PRECAST TRUSS

To speed up the filling of cylinders a floating concrete plant was built; the setting of cylinders along the heart of the pier cylinders was always at the outer edge

VIEW IN THE CASTING STORAGE YARD
Showing bearing piles, sheet piles, fender beams, trusses and cylinders.

of the falsework and could be easily reached. This plant is also used as a booster in helping concrete the deck.

Prevention of Dust Explosions in Grain Elevators

Rules Proposed by Fire Protection Association to Regulate Construction, Equipment, Operation and Cleaning

WITH the aim of reducing the number and severity of dust explosions in elevators and mills, tentative rules governing building construction, machinery equipment, dust prevention and dust removal were submitted at the annual meeting of the National Fire Protection Association, in Chicago, by the committee on Dust Explosion Hazards. Separate sets of rules apply to terminal grain elevators, flour and sugar mills, pulverized fuel systems and cocoa grinding and pulverizing systems. An abstract of a portion of the rules relating to grain elevators is given below.

Building Construction — Interior walls, including bin walls, shall be smooth and free from pockets or ledges on which dust may accumulate, but where ledges cannot be eliminated they shall have a smooth surface and be made as steep as possible. Pipes and conduits that must be exposed shall be fastened in such a manner as to present a minimum surface for the accumulation of dust.

Roofs and walls of belt conveyor galleries, the side walls of all cupolas above bins, also all curtain walls below bins, shall be of light material offering little resistance to explosive energy. The term "light material" contemplates corrugated galvanized iron, corrugated zinc, corrugated asbestos, brick-tile or gunite, and for cupola construction it is intended to apply only to curtain or panel walls between columns. Concrete may be used if the window area is greater than the minimum noted below.

If the track shed, in which cars are loaded and unloaded, is immediately adjacent to the working house, it must be separated from the latter by a solid dust-proof partition of light material. Fixed windows may form a part of this partition. All other buildings forming part of the elevator shall be spaced as far apart as practicable. Connections between buildings shall be only by belt galleries, tunnels or sprouts. Tunnels not wholly underground must be provided with natural light, and in any event must have adequate ventilation. Where galleries or tunnels are connected to main buildings a partition or fire door shall be provided, solid except for entrance door and apertures for conveyor belt. The entrance doors shall be hinged to swing into the tunnels and shall be self-closing. Small doors or slides, equipped with either fusible link or automatic closing device, shall be provided to close the apertures for conveyor belts in case of fire or explosion.

All storage bins shall be covered, the side walls extending solidly to the roof of the bins, there being no connection between bins. Each storage bin shall be vented to the outside atmosphere by a vent pipe of sufficient size. All bins in the outside rows of the working house shall be vented to the outside atmosphere, but interior bins may be vented into the story over the bins when mechanical difficulties make it impossible to vent such bins to the outside atmosphere.

Tunnels and basements shall extend as much above natural ground level as practicable and shall be large and roomy. All tunnels and basements shall be dry and shall have all the natural light possible, either by means of windows, areaways or sidewalk glass. Basements of all buildings shall be of such construction as to permit the free circulation of air and shall be vented by air shafts exhausting above the roof or by other approved method. Fans or blowers shall be provided when the natural ventilating capacity is not sufficient to provide one complete change of air per hour. To provide adequate air inlet in basements at all times, permanent openings shall be made in addition to the doors and windows.

All buildings and operating rooms shall be provided with a large area of windows or a combination of windows and louvres, the minimum allowance to be as follows: For cupolas and drier building, 40 per cent of the free wall area (space between columns). For galleries between buildings, also shipping galleries, 10 per cent. For track shed and first story of other buildings, 50 per cent. All windows shall be glazed with plain glass, shall be easily operative and arranged to provide the maximum ventilation when open, and shall be preferably of the hinged or tilting type.

Roofs of track sheds, drier buildings, galleries and all cupolas shall be provided with sufficient monitors or ventilators to insure, in conjunction with the windows, one complete change of air per hour, in the area thus ventilated.

Removal of Suspended Dust—All elevator leg heads, garners over scales, and scale hoppers shall be equipped with vents to the outside atmosphere.

Discharge ends of all belt conveyors, boots of all elevator legs, all fixed belt loaders, and other points where there is a throw of the grain, shall be provided with adequate air aspiration, so arranged as to collect only the floating dust that might otherwise escape into the building. Air aspiration shall be strong enough to remove only floating dust and not kernels of grain.

Drier units shall be provided with an adequate system for the removal of dust created through the operation of driers. Cleaning machines shall be equipped with dust collecting systems.

Dust collectors shall be of the cyclone type, at least 90 per cent efficient, and shall be located outside the elevator buildings. They shall exhaust 10 ft. or more above the roof of the plant, or be so arranged that there will be no opportunity for the dust from the exhausts to get back into the elevator.

Removal of Static Dust—All elevators shall be equipped with some type of pneumatic or other effective system for the removal of static dust which collects on floors, side walls, spouts, ledges and boot tanks. The vacuum system is recommended. So far as practicable the use of brooms and brushes for dust removal shall be discontinued.

For removal of dust from motors, drier coils and other inaccessible surfaces, all elevators shall be equipped with a compressed air system, operating at from 80 to 100-lb. pressure. Either fixed compressor with suitable piping and hose or a portable compressor set may be used. When the latter is used it shall be provided with a tank of sufficient capacity to maintain pressure for a considerable length of time, making it unnecessary to bring the tank to pressure while in the elevator.

From the American Association of Engineers' Convention

Rules of Professional Conduct, a New Standard License Law for Engineers, and Other Reports Presented at Norfolk, Va., May 7-9 — Congressman Smith on the Engineer's Political Duty

Principles of Good Professional Conduct for Engineers

From Report of National Practice Committee

THE PRINCIPLES enunciated herein were drawn from decisions in cases of question or difference of view as to professional conduct, of which 44 have been decided by the committee. In the original draft of these principles five were included (two each in Parts I and II, one in Part IV) which are omitted in the present reprint, as they were referred back by the convention, for restudy and revision. The principles as here reproduced were adopted by the convention.

Part I. Relations of the Engineer to the Public

1. The engineer should regard his duty to the public welfare as paramount to all other obligations.
2. He should not use his professional standing as a means of sponsoring or promoting commercial or other undertakings of a speculative character.
3. He should scrupulously avoid connection, by act or omission, with any illegal or questionable undertaking or participation in any enterprise inimical to the public welfare.
4. He should not advertise in self-laudatory language or in any other manner derogatory to the dignity of his profession.
5. He should avoid any publicity giving the impression that technical service in technical matters can be dispensed with; or that technical proficiency along any line is easy of acquisition; or that exaggerated returns may be expected from any limited course of technical instruction.
6. He should avoid any questionable statements or any statements couched in language that would convey a false impression, in any of his reports, advertisements or articles.
7. He should refrain from using any improper or questionable methods of soliciting professional work.
8. He should participate in clean politics and should strive to be a force to assist in the cleansing of politics.
9. He should take an active interest in the public welfare in behalf of which he should ever stand ready to volunteer his special knowledge, skill and training for the use and benefit of mankind.

Part II. Relations of the Engineer to Clients and Employers

1. The engineer should pursue his professional work in a spirit of strict fidelity and full loyalty to his clients and employers.
2. He should inform a client or employer of any business connections, interests or affiliations which might tend to influence his judgment or impair the disinterested quality of his services.
3. He should accept compensation for his services in connection with any work from one source only, except with the full knowledge and consent of all the interested parties.
4. He should regard and maintain as confidential any information obtained by him relating to the business affairs and technical methods or processes of a client or employer.
5. When connected with any work, he should not accept commissions, outside employment, promise of employment, or any other consideration from a contractor engaged upon that work.
6. He should have no business dealings or connections with any client of his employer without the full knowledge and approval of his employer.
7. He should entertain no offers of employment or other considerations from a third party, when such may in any way influence his actions or decisions with respect to the relations which may exist between such third party and the engineer's employer or client.
8. He should not accept commissions or other considerations for specifying or recommending supplies, equipment or service.
9. He should have no interest, direct or indirect, in any materials, supplies or equipment used in the construction work of his client or in any firms receiving contracts for his client's work without in advance informing his client of the nature of such interest and obtaining his sanction.
10. He should not engage in the independent practice of engineering without the knowledge and sanction of his employer, and under no circumstances should he compete with his employer on the basis of lower fees.

Part III. Relations of Engineers to Employees

1. The engineer should treat his employees or subordinates in a spirit of fairness, with due regard and consideration for their personal welfare and professional advancement.
2. There should be a professional bond between employer and employee when both are engineers, which will dictate and impel reciprocal interest and mutual consideration.
3. The engineer should pay adequate salaries, commensurate with the importance and responsibility involved in the service.
4. He should encourage the professional pride of his employees or subordinates in their work and should offer them every means of protecting their reputations and the quality of the work entrusted to them by not interfering with the proper performance of the duties for which they are responsible.
5. He should recognize the freedom of his employees to change employment and should in no way hinder employees or subordinates in bettering their condition.
6. He should not discharge an employee, nor withhold employment from him, nor discriminate against him in any way on account of his affiliations or activities in any professional, political or religious organization.
7. He should respect his employee's right to freedom of thought, speech and outside activity as long as the same does not impair the efficiency and value of the employee's service.
8. He should see that his employee is adequately covered by insurance against risk of casuality arising from his work.
9. In advertising or offering employment, he should refrain from any misrepresentation as to the conditions and permanency of such employment.
10. If in public employ, he should assume the responsibility of consistently protecting the interests of his subordinates.
11. He should make every effort to provide steady employment for his employees and when forced to discharge an employee he should give the most generous notice possible and exert every reasonable effort to assist the employee in finding another position.

Part IV. The Engineer's Relations to Other Engineers

1. The engineer should not by word, act or omission injure falsely or maliciously, directly or indirectly, the professional reputation, prospects or business of another engineer.
2. He should not attempt to supplant another engineer after definite steps have been taken toward his employment.
3. If employed in conjunction with another engineer, and by the same client, he should not review and comment conclusively upon the work of the other engineer except with his full knowledge and consent or unless the connection of such other engineer to the work has been previously terminated.
4. He should not use unfair means to effect his professional advancement or to injure the chances of another engineer to secure and hold employment.
5. He should not attempt to inject his services into a project at the expense of another engineer who has been active in developing it.
6. He should not interpose between other engineers and their clients when unsolicited. When solicited, he should

avoid any possibility of doing a brother engineer an injustice.

7. He should not seek or solicit a position occupied by another engineer.

8. He should not attempt to secure work on the basis of lower salaries or fees.

9. He should be courteous, fair, considerate in his dealings with other engineers.

10. He should not commercialize his affiliations with, or official position in, any technical organization.

11. He should not use his professional affiliations to secure the confidence of other engineers in speculative commercial enterprises.

12. As a member of any professional organization, he should avoid any act tending to promote his own interest at the expense of the dignity and standing of the organization.

13. As an officer of a professional organization, he should sedulously avoid any appearance of using his position for personal advertising.

14. He should co-operate in upbuilding the engineering profession by exchanging professional information and experience with his fellow engineers and students of engineering and by contributing to the work of engineering societies, schools of applied science, and the technical press.

15. He should regard himself as a debtor to his profession and should dedicate himself to its advancement.

* * *

A Neglected Duty of the Engineer

From an address by Hon. Addison T. Smith, Chairman, Committee on Irrigation of Arid Lands, House of Representatives

YOUR profession has done and is doing more, possibly, than any other profession for the safety, comfort and happiness of the people. You have spanned the rivers, tunneled the mountains, and erected mighty structures which excite wonder and admiration. You have added to the prosperity and comfort of teeming millions throughout the world. In addition to these great accomplishments, it seems to me, you should be taking a more active part in the preservation of our institutions and in making our laws.

Why do we have so few engineers in active political life? There is no higher duty for the citizens, especially for those who are educated, than that of the study of statecraft. The first consideration of society is good government. Without good government it is not possible for the citizen to enjoy the fruits of his toil, or to be protected in his life, liberty and the pursuit of happiness.

To you men, educated as engineers, "duty" is an appealing word. We frequently hear complaints from all directions concerning our legislators, and often from those who take no interest in politics. Are we doing our part in helping to nominate good men for office, and aiding in electing them? And after all this has been done, are we taking them into our confidence and aiding by suggestion and argument in influencing the enactment of laws which will advance the general welfare?

Because of his technical education and experience in handling large affairs the engineer is naturally a man of influence in his community, and on this account could be helpful in formulating policies and carrying out plans which would be of the greatest benefit to the state and nation. Have you been content to let others take the lead when it comes to great public matters for which your education and experience equip you?

With the trained vision and the ingenuity which distinguish your profession, you have a greater duty, and a greater opportunity for enjoyment of that duty, than have men of other professions. Having this duty and opportunity, you should use it—not merely in handling the materials and forces of Nature for the good of men, but you should consider and act upon ways and means for putting your knowledge into the really practical politics of every-day life, particularly where these affect the proper use and enjoyment of our natural resources. So far as legal, legislative and judicial functions are concerned, we have not yet made the same substantial advance as has been done in engineering; we have not devised a system of laws which will bring to all the people their share of life comforts and enjoyments. If we are to advance, we must utilize more of the vision of the engineer, and put into practical use the ingenuity and initiative which are supposed to be his peculiar characteristic.

I am brought into peculiarly intimate relations with engineers, and in event of the adoption by Congress of a broad national policy of reclamation and settlement of waste lands in all parts of the country, which has been under consideration by Congress for several years, I expect to be even more closely associated with men of your profession. There is much to be done in the way of education of the public on the needs and opportunities of reclamation; also there are obstacles to be overcome in the way of constructive legislation. My committee welcomes any suggestion which you, as citizens from different parts of the country, may make in this connection, because I know that you not merely understand the mechanical or material obstacles to be overcome but also have the local viewpoint as to the human problems and relations.

I have more confidence in the value of the help that you may render because I have seen some of the works which you have devised and constructed. My home-state of Idaho, and especially the southern part where I live, may be said to be largely a creation of the engineer, in that land values, and nearly all prosperity rests upon the adequacy of the structures for water supply built by engineers in private or governmental employment.

In the extension of reclamation work to all parts of the United States, waste lands in the South and East must be reclaimed by drainage. The required works, while perhaps not as picturesque as the great reservoir dams of the West, in the aggregate may be difficult and expensive to build. It is not, however, the magnitude of the work which calls into play the highest engineering skill; many intricate problems must be solved, particularly where question of economy and permanence is involved.

In the past you have not done all that might have been done in the way of seeking political preferment and taking an active interest in public affairs. I hope for you a wider vision as to the opportunities which are before you, and particularly of the duties to the public which you can perform, not merely in your technical capacity but even more in your ability to enlighten and lead your fellow-citizens.

* * *

New Standard License Law

IN THE following paragraphs is given a revised draft of the new standard license law adopted by the association May 7, 1923, on the basis of a report of the legislative committee and subsequent revision of a special committee made up largely of members of state examining boards. The adopted bill is subject to editorial correction and to annotation which is to indicate the manner of applying the standard to varying conditions of different states.

Sec. 1—In order to safeguard life, health, and property any person practicing or offering to practice as a professional engineer or a land surveyor in this state shall hereafter be required to submit evidence that he is qualified so to practice, and shall be registered as hereinafter provided, and from and after twelve months after this act becomes effective it shall be unlawful for any person to practice or offer to practice as a professional engineer or a land surveyor in this state unless such person has been duly registered or specifically exempted as required by the provisions of this act.

Sec. 2—Nothing in this act shall be construed as requiring registration for the purpose of practicing professional engineering or land surveying by an individual, firm, or corporation on or in connection with property owned or leased by said individual, firm, or corporation unless the same involves the public health or safety, or the health and safety of employees of said individual, firm, or corporation; provided, however, such person shall not represent himself as, or use the title of, registered professional engineer unless such person is qualified by registration under this act.

Sec. 3-7—[Create a state board of registration for professional engineers and land surveyors of five members appointed by the Governor, the members to be professional engineers and not more than two of them to be from the same branch of the profession, one being also a skilled land surveyor; provide for a four-year term of office,

initial appointment of a board by the governor, removal of members by the governor, power to take testimony, employment of a secretary by the board, election of officers and adoption of rules and by-laws, compensation of the board and payment of expenses from moneys received, and publication of an annual roster of registered professional engineers and land surveyors to be filed with the secretary of state and with each county clerk.]

Sec. 8—Application for registration shall be made to the board on form prescribed by it, accompanied by a fee not to exceed $15 for professional engineers and $10 for land surveyors, such fee to be retained by the board. The application shall contain satisfactory evidence under oath that the applicant (a) is more than 21 years of age; (b) is of good character; (c) has engaged in the practice of professional engineering of a character satisfactory to the board for at least six years—graduation from an engineering school of recognized standing shall count as three years of practice; or (d) has engaged in the practice of land surveying of a character satisfactory to the board, for at least four years—two years of technical school work successfully done shall count as two years of that experience, provided the college work included the study of surveying with the necessary mathematics.

Sec. 9-11—[Provide for examinations for registration at least twice a year, either oral or written or both, or an investigation of the applicant's professional record; registration without examination within one year after adoption of the act, on evidence that the applicant is engaged in practice; and issuance of a registration certificate for a fee of $10.]

Sec. 12—The board shall, from time to time, examine the requirements for the registration of professional engineers and land surveyors in other states, territories and countries, and shall record those in which, in the judgment of the board, standards not lower than those provided by this act are maintained. The board is hereby empowered to arrange for reciprocal registration of professional engineers and land surveyors in other states or countries and to allow registered professional engineers and land surveyors from those states, territories, and countries so recorded to practice in this state under terms mutually agreed upon. The secretary of the board, upon the presentation to him by any person of satisfactory evidence that such person holds a reciprocal registration certificate issued to such person by proper authorities in any such state, territory or country, shall, upon the payment of a fee of $1, issue to such person a certificate of registration under this act.

Sec. 13—The board shall have power to revoke the certificate of registration of any professional engineer or land surveyor registered hereunder who is found guilty of any fraud or deceit in his practice or in securing a certificate of registration, or of gross negligence, incompetence or misconduct in the practice of professional engineering or land surveying. [Charges to be in writing, a hearing to be held within three months, a four-fifths vote of the board to be necessary for revocation, and appeal allowed to civil courts.]

Sec. 14—[Fixes annual renewal fee for renewal certificate.]

Sec. 15—[Provides for use of authorized seal by a registered engineer or surveyor.]

Sec. 16—Nothing in this act shall be construed as prohibiting a corporation, association or partnership from engaging in the practice of professional engineering or land surveying in this state, provided the person or persons connected with such corporation or partnership in responsible charge of the designing or supervision, which constitutes such practice, is or are registered as herein required for professional engineers or land surveyors. The same exemptions shall apply to corporations as apply to individuals under this act.

Sec. 17—[Exempts from the provisions of the act a non-resident offering to practice; a non-resident practicing not more than 30 days in any calendar year, if he is registered in his own state; a non-resident practicing during the time his application for registration is pending; a non-resident practicing as consulting associate of a registered professional engineer or land surveyor for not more than 30 days in any year; employees of registered or exempt engineers or surveyors; and government officials. No exempt persons are authorized to use the title registered professional engineer, professional engineer, or registered land surveyor.]

Sec. 18—[Provides penalties for unauthorized practice or offer to practice, wrongful use of registration certificate, false evidence before the board, etc.]

Sec. 19—This act shall not apply to any architect registered by the state under the provisions of the act creating the State Board of Architecture. [This section to be used only when there is already a law on the statute books licensing architecture.]

* * *

Public Works Planning as Related to the Tax Burden

From the Presidential Address of A. N. Johnson

THERE IS an insistent demand for a reduction of the tax rate, and an equally insistent demand for public improvements: a demand for economy on the one hand, coupled with a demand for expenditures on the other. Can these demands be reconciled?

We know from long experience that money for public improvements has been lavishly voted without much consideration of any settled policy. We begin today what we find ourselves unable to finish tomorrow. We stop what we have begun, only to make a fresh start, with the loss of energy required to get under way once again—quite comparable in effect to stopping and starting a heavy train.

A most obvious saving and ultimate economy would result if a continuing sound policy toward public improvements were first formulated and then followed. Year after year, in city, county and state, as well as in national government affairs, engineers have made recommendations and laid down plans of procedure for prosecution of various works over a period of years. But these plans and suggestions have somehow not met with effective public support. The very fact that politicians have seen fit often to follow quite a contrary course is evidence that they know that the engineers' recommendations have but small weight with the public generally. It must, therefore, rest with the engineers themselves to arouse public sentiment, to make clear to all that if real economy is to be secured a logical plan of procedure must prevail. In such a course lies the only hope for ultimate reduction in wasteful expenditures for public improvements.

The improvements must be made; expense must be reduced. The engineers are in position to accomplish much toward a solution of the problem. But it is not sufficient that a good plan be evolved, a sound policy outlined. The public must be convinced. In this situation there is a distinct place for the engineer, both for himself and the public to consider.

* * *

Public-Service Engineering Compensation

From Progress Report of Committee on Salaries of Engineers in Public Service

THE REPORT recommends reaffirming the salary schedules adopted by the association, and discusses means for bringing about their adoption by public officials. Finally, in the extract quoted, it points out that engineers themselves must fight for adequate compensation.

Just as long as engineers will work for their present small salaries the public is not going to worry at all about what the engineer thinks of the inadequacy of these salaries. The engineer need not delude himself that his sacrifices are appreciated by anybody but his family and himself, for they are not. The attitude of the public is, in the first instance, one of supreme indifference as to the engineer's compensation. This will always be true. When, in the second instance, the public learns of the engineer's discontent these questions immediately are raised: "He knew what the job paid before he asked for it. If he didn't like the pay why did he ask for the job? If the pay is so poor why do so many seek these jobs?" The engineer's eternal hope for an increase, based on recognition of the true value of his services, as well as his more or less unselfish desire to render a public service, alike are unknown to the desperately busy and preoccupied public.

Good Practice in the Design of Crane Runways

A Condensed Discussion of Impact Effect, Lateral Stiffening, Expansion, Rail Fastening and Miscellaneous Points

By Robins Fleming
Structural Engineer, American Bridge Co., New York City

METHODS of calculating stresses and proportioning members of crane runways may be found in textbooks, but some points on design which experience shows to be important are not usually found in the books. The present article discusses a number of such points.

Load Data—If the designer knows whose make of crane will be used, he can design for actual wheel loads and clearances. But a mill building or crane runway is often designed and fabrication commenced before the owner has bought the crane, and the designer then must use available information on other cranes of the lifting capacity that is to be provided for. A table of loads, wheel bases and clearances for electric traveling cranes prepared by the writer for Merriman's "American Civil Engineers' Handbook" (4th edition, p. 829) is, by permission of the publishers, reproduced here as Table I.

TABLE I—LOADS AND CLEARANCES FOR ELECTRIC CRANES

Capacity Tons (2,000 Lb.)	Span, Ft., C. to C. Rails (A)	Wheel Base, Ft. and In. B	B_1	B_2	Max. Load, Lb., For Each Wheel (W)	Vertical Clearance (C) Ft. and In.	Side Clearance (D) In.	Rail, Lb. per Yd.
5	40	9-0	...	...	13,000	6-0	10	50
	60	10-0	...	...	15,000	6-0	10	50
	80	11-0	...	...	18,000	6-0	10	50
10	40	9-0	...	...	20,000	6-6	12	60
	60	10-0	...	...	23,000	6-6	12	60
	80	11-0	...	...	26,000	6-6	12	60
15	40	10-0	...	...	30,000	7-0	12	60
	60	11-0	...	...	33,000	7-0	12	60
	80	12-0	...	...	36,000	7-0	12	60
20	40	10-6	...	...	35,000	7-6	12	80
	60	11-6	...	...	39,000	7-6	12	80
	80	12-0	...	...	43,000	7-6	12	80
30	40	11-0	...	...	50,000	8-0	13	80
	60	12-0	...	...	54,000	8-6	13	80
	80	13-0	...	...	59,000	8-6	13	80
40	40	12-0	...	...	66,000	8-6	14	100
	60	13-0	...	...	71,000	9-0	14	100
	80	14-0	...	...	77,000	9-0	14	100
50	40	13-0	...	...	80,000	9-6	15	100
	60	13-6	...	...	85,000	10-0	15	100
	80	14-0	...	...	90,000	10-0	15	100
75	60	12-0	5-0	...	65,000	12-0	16	100
	80	14-0	5-0	...	70,000	12-6	16	100
100	60	12-0	5-0	...	90,000	14-0	18	150
	80	14-0	5-0	...	95,000	15-0	18	150
125	60	13-0	5-0	...	110,000	15-0	20	175
	80	15-0	5-0	...	120,000	16-0	20	175
150	60	18-0	5-0	...	130,000	16-0	22	175
	80	20-0	5-0	...	140,000	17-0	22	175
175	60	14-0	7-0	3-6	65,000	17-0	24	150
	80	19-0	7-0	3-6	75,000	18-0	24	150
200	60	14-0	7-0	3-6	75,000	17-0	24	150
	80	19-0	7-0	3-6	85,000	18-0	24	150
		Loads and Clearances for Hand Cranes						
2	30	4-0	...	...	3,500	4-0	7	30
	50	5-0	...	...	4,000	4-0	7	30
4	30	4-0	...	...	5,500	4-6	8	30
	50	5-0	...	...	6,500	4-6	8	30
6	30	6-0	...	...	8,000	5-0	9	40
	50	7-0	...	...	9,500	5-0	9	40
8	30	6-0	...	...	10,500	5-0	10	50
	50	7-0	...	...	12,000	5-0	10	50
10	30	7-0	...	...	13,000	5-0	10	50
	50	8-0	...	...	14,500	5-0	10	50

Loads given do not include impact.

Data relating to a proposed 250-ton crane submitted by different manufacturers are given in Table II. In this table the term "double track" means two rails 7 to 10 in. apart on each girder, the crane wheels being made to bear on both rails; the wheel load given is the load on each rail.

The designer of a runway to carry a crane of 100 or more tons capacity should have the opportunity of reviewing his calculations from data obtained after the crane is purchased. It is well for him to do so in all cases, but it is especially important with cranes of unusual capacity.

TABLE II—DATA FOR 250-TON ELECTRIC TRAVELING CRANES

Manufacturer	Capacity, Tons: Main	Capacity, Tons: Auxiliary	Span (A), Ft. and In.	Wheel Base: B_1, Ft. and In.	Wheel Base: B_1, Ft. and In.	Wheel Base: B_2, Ft. and In.	Max. Wheel Load (W), Lb.	Vertical Clearance C, Ft. and In.	Side Clearance D, In.
X	250	40	100-0	17-0	8-0	3-6	110,000	19-6	2-0
Y	250	40	100-0	17-0	7-6	3-0	110,000	19-6	2-0
							Double Track		
Y	250	25	70-9	16-0	5-0	...	115,000	21-6	3-0
							Double Track		
X	250	25	70-9	8-0	4-0	...	93,000	21-6	2-9
							Double Track		
X	250	25	70-9	18-0	3-5	...	120,000	21-6	2-9
Z	250	40	100-0	15-0	7-9	3-3	109,500	19-6	2-9
							Double Track		
Z	250	25	70-9	11-0	5-0	...	92,500	21-6	4-6
							Double Track		
Z	250	25	70-9	11-0	5-0	...	105,000	21-6	4-3

Loads given do not include impact.

Impact—Stresses due to wheel loads should be increased 25 per cent for impact, or, what is the same thing, the actual wheel loads should be increased 25 per cent. Some engineers think that impact should be assumed in accordance with the capacity of the crane. A 5- or 10-ton crane, they think, is subject to much rougher usage than one of 40 or 50 tons, and for this reason they would reduce the impact of 25 per cent to 10 per cent for the heavy crane. This reasoning is not verified by experience. A careless operator may be in the cage of a 50-ton as well as in that of a 10-ton crane. Sudden stopping or starting, pulling loads at an angle, slips in the hoisting chains are common to heavy cranes as well as to light ones.

The minimum distance between two cranes on a crane runway usually varies from 2½ ft. for 5-ton cranes to 5 ft. for 50-ton cranes, center to center of adjacent end wheels. It is improbable that when the cranes are close together both of them will be carrying maximum load, and therefore no impact need be included when stresses due to two cranes on the same girder are computed. Of course if the stresses obtained are less than the stresses due to a single crane with impact, the girder should be proportioned for the latter case.

For hand-power cranes impact may be assumed at 10 per cent; girders designed on this basis have proved amply rigid in practice.

Longitudinal Traction Stresses—The tractive force to be resisted on each side of the runway may be assumed at 10 per cent of the load on that side from all the cranes, distributed along the entire length of the runway or between expansion joints in a long runway. Kneebraces from girders to columns are commonly used to resist the longitudinal forces. A better way, where practicable, is to carry the traction stresses to the ground by diagonals in occasional bents, say 100 or 150 ft. apart. If this is done, kneebraces can safely be omitted throughout.

Expansion and Contraction—How much provision should be made for expansion and contraction in crane runways depends largely upon the variations of temperature to which they are liable. Runways under ordinary conditions have been built 600 ft. and longer without any provision for expansion save that the ends were free to move, that is, they were not confined by any adjoining structure. This allows 300 ft. of runway to expand or contract by the tipping of the columns. There is a case

of a shipyard runway 1,000 ft. long resting on columns 57 ft. high which has no provision for expansion, but the length of 600 ft. should seldom be exceeded without some provision being made. Runways about furnaces should receive special consideration because of the chance that they may be frequently subjected to high temperatures.

Long lines of girders are liable to overrun in length unless great care is used in fabrication. Expansion joints, allowing adjustment in erection, are one means of overcoming this difficulty.

Lateral Stiffness—Provision should be made to resist the horizontal thrust due to the travel of the load upon the crane bridge. Much trouble in runway girders has come from failing to properly care for this thrust. A common requirement in specifications is that the horizontal thrust on a crane runway shall be assumed equal to 20 per cent of the lifting capacity of the crane, divided equally among all the wheels or 10 per cent divided equally between the wheels bearing on one rail. This thrust, applied at the top flange of the girder, subjects it to double duty in resisting both vertical and horizontal

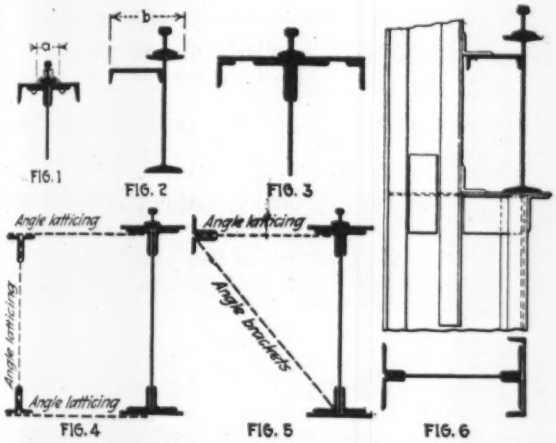


FIG. 1 FIG. 2 FIG. 3 FIG. 4 FIG. 5 FIG. 6

RIGHT AND WRONG DETAILS OF CRANE RUNAWAYS

bending, and makes necessary the provision of additional strength as well as stiffness in this flange. To meet these requirements the design of top flange shown by the sketch Fig. 1 is recommended in some text-books, a channel over two angles. This is easy of calculation, but its use is quite limited in practice. To secure an even bearing of rail on the channel, unless the clear distance, *a*, between heads of rivets, is greater than the width of rail base (or splice bars if the angle type is used), the rivets must be countersunk and chipped. This is difficult to do satisfactorily in the thin webs of channels, besides being costly. To bring rivet heads outside the base of the rail, flange angles with not less than 5-in., preferably 6-in., outstanding legs should be used. The covers can be flat plates if of sufficient lateral strength, rolled channels if it is practicable to use them, or built-up channels, as in Fig. 3.

The working flange stress from vertical loading with impact added is usually given in specifications as 16,000 lb. per sq.in. net tension. When the ratio of the laterally unsupported length, *l*, of the top flange to its width, *b*, exceeds 12, the compressive working stress should not exceed 19,000 — 250 *l*/*b*. For combined lateral and vertical loadings the working stress may be increased 12½ per cent, provided the section thus obtained is not less than that from the vertical loading alone.

To avoid undue deflection from moving loads the depth of crane girders should be not less than 1/16 the span length.

Girders of short span and for cranes of moderate capacity are often made of a single I-beam stiffened by a horizontal channel attached close to the top flange, as in Fig. 2. The vertical loads may be considered carried by the I-beam and the lateral loads resisted by the channel. In determining the working stress to be used in the top flange for vertical loading the width *b* in ratio *l*/*b* is considered the distance *b* in Fig. 2. A stress of 16,000 lb. per sq.in. is used for the horizontal channel. No impact is added to the assumed lateral loading. Table III, a list of I-beam girders with lateral stiffening channels for some runway sizes in common use, is taken from the standards of a fabricating company.

TABLE III—CRANE GIRDERS FOR CRANE OF 60-FT. SPAN

Capacity Of Crane, Tons	16-Ft. Girder		20-Ft. Girder		24-Ft. Girder	
	I-Beam	Channel	I-Beam	Channel	I-Beam	Channel
	In. Lb.	In. Lb.	In. Lb.	In. Lb.	In. Lb.	In. Lb.
5	15–42.9	8–11.5	18–54.7	8–11.5	20–65.4	10–15.3
10	18–54.7	8–11.5	20–70	8–11.5	24–79.9	10–15.3
15	20–65.4	8–11.5	24–79.9	8–11.5	24–115	10–15.3
20	24–79.9	8–11.5	24–95	10–15.3	Plate Girder	

Runways carrying heavier cranes or of longer spans than those shown in Table III are made of plate girders. For lengths up to about 35 ft. the top flange may be stiffened laterally by a built-up channel of a plate and two angles, as in Fig. 3. The plate should be of a width not less than 1/20 the span length. As before mentioned, the gage of rivets in outstanding legs of angles should be such as to allow the base of rail to clear rivet heads without countersinking. For long spans, especially in out-of-door runways, stiffening girders are necessary; Fig. 4 is an illustration. The two girders should be not less than 1/12 to 1/15 the span length apart. A section as in Fig. 5 should not be used. Experience, costly in one case, has shown that, especially in long spans, the horizontal girder under stress is liable to deflect, throwing stress into the angle brackets and causing twisting in the main girder.

Where two runways adjoin, the inner girders can usually be latticed together, thereby reducing the amount of material over that required for stiffening each girder separately.

Rail Fastenings—The fastening of rails to girders is quite important. For rails resting on I-beams, hook bolts in pairs about 2 ft. center to center of pairs are used. Bolts ¾ in. in diameter may be used for 40-lb., and ⅞ in. for 60- and 80-lb. rails. They should be made to allow ½ in. adjustment either way for alignment of the rails. Rails resting on the top flanges of built-up girders should be attached by clamps spaced not more than 3 or 4 ft. apart. Clamps require not less than 6-in. legs; the adjustment of the rails is obtained by means of eccentric washers (patented clamps that have given excellent satisfaction are on the market). Substantial splice bars should be provided for the rails. Split washers or nut locks should be used on all hook bolts and bolts for rail clamps, rail splices and crane stops.

Riveting of rails to top flanges is not to be commended, as it gives no means for adjusting the alignment.

Crane Columns—Crane runway girders in industrial buildings rest either on column brackets or on columns with the lower part made wider than the upper in order that the load from the crane girder may be transmitted

directly to the column base. By reason of the eccentricity involved the use of brackets should be restricted to cranes of not more than 10 tons capacity, preferably 5 tons. In proportioning columns the bending stresses from bracket loads should be calculated and added to stresses from direct loads. With columns as in Fig. 6, eccentricity is reduced to a minimum; the crane-girder load is carried to the base by the channel, the two connecting angles and the portion of the web plate between. For heavy loads an I-bean is sometimes used instead of a channel. In columns of the gun shop of the Crucible Steel Co. at Harrison, N. J., 20-in. I's and 6 x 6-in. angles were used.

Separate columns are sometimes used under crane girders. These possess the advantage of having stresses determinate, but require more steel and are not as stiff laterally as the wider columns of Fig. 6. Separate girders and columns, parallel and close to those carrying galleries, were used for the crane runway in the machine shop of the American Bridge Co. at Pencoyd, Pa. This was done at the suggestion of the late P. L. Wolfel. His object, to prevent vibration in the gallery floors from the running of the crane, was thoroughly accomplished, although at considerable expense.

The girders of out-of-door runways are often supported by A-shaped frames. The spread at the base should be not less than one-fifth the height. To make available as great an area covered by the crane as possible the inner leg of the frame is made vertical and thus carries most if not all the direct load. The outer leg acts as a brace or backstay. A-frames should be designed for lateral stiffness as well as for direct loads.

When runway girders are made as in Fig. 4 they should, if not too high, be supported by wide latticed columns with vertical legs, one leg under each girder. The legs are usually rolled or built-up channels or I-sections.

Crane Clearances—Ample clearances should be allowed—not less than 2 in. for side and 3 in. for vertical. By clearance is meant the distance between the crown of rivet heads in the steel structure and the outermost portion of the crane. The reasons for clearance are obvious. Columns may not be straight or perpendicular to the base, trusses may deflect, or there may be a slight unlooked-for projection on either truss or crane.

Other Points—In designing crane girders, the resistance of web plates to buckling and the strength of stiffeners, especially end stiffeners, should be considered. In these particulars, standard specifications, such as those of the A.S.C.E. or the A.R.E.A., can be followed.

The designer should bear in mind the detailer. A mistake not uncommon is to make the vertical leg of the top flange angles of girders of a depth that will allow but a single row of rivets, when two rows may be required to take horizontal shear and vertical load. Rivets should be spaced for horizontal shear in the bottom flange and for the resultant of horizontal shear and vertical wheel load in the top flange. Wheel loads may be assumed to be distributed by the rail over a length equal to the depth of the girder but not to exceed 30 in.

Ladders should be provided at each end of a crane runway, at the cage end of the crane.

Yard crane girders should have rigid connections to A-frames, and the tops of the A-frames should not be made too narrow. No light members should be used in yard runways. Cover plates should be used on all outside girders, otherwise water is liable to collect in the trough between the angles under the rail and cause corrosion where strength is most needed for supporting the rail.

Girders in adjacent spans should have the same depth when practicable, even if the span lengths of the girders are different.

When crane runways are installed in old buildings care should be taken that the buildings are strengthened, where need be, for direct loads and vibration. Additional bracing is usually requred.

Rail splices should be staggered by not less than 10 ft., i.e., the splice on one side of the runway should not come opposite the splice on the other side by that distance. Joints between rails should be left in perfect adjustment so that there will be no jar when wheels pass over rail ends.

Crane Troubles—Faulty design in the runway has been the cause of many crane troubles. The lack of lateral stiffness in the girders has already been mentioned. But it should not be assumed that the cause of all crane troubles is in the design of the runway. "Of course we hold the builders of the runway responsible," said a superintendent to the engineer sent to investigate the reason of a crane continually getting out of alignment. The crane, though of 75 tons capacity, had been overloaded 60 per cent and the wheel base was too short for the span of 100 ft.; but the real cause of the difficulty was that the wheels at one end carriage were not exactly the same size as those at the other, thus causing a binding action in the crane and throwing the rails out of alignment.

In another instance the foundations were settling unevenly. In a third, the crane itself had become askew, one end running 8 or 9 in. ahead of the other. In still another, two cranes on the same runway were continually being brought close together. The girders were of long span and designed for but one crane and were thus overloaded, causing decided vibration. This is not a lone instance.

The only remedy to prevent overloading in cases like the last mentioned is to attach a permanent spacer to one crane; instructions to crane operators are not sufficient. There may be exceptions to this rule, however. The writer has in mind an extension built of a strength nearly double that of the original runway. Upon calling attention to the fact he was told that instructions would be given that loads of the full capacity of the new crane should be carried midway between the girders of the old portion. Five years have passed and no trouble has been reported, so that presumably instructions have been followed; there is still time for an accident, however.

Two common causes of crane troubles are neglect and carelessness. Crane runways are seldom examined until there is trouble. The rail fastenings are then usually found to be loose. It is submitted that a structure of this nature should be viewed in the same light as a railroad track, where the rails are watched continually for changes in alignment and for looseness in the connections. Operators are often careless in allowing heavy pieces to swing and strike the supports. An examination of runways about steel mills, foundries and shipyards often shows badly indented columns and bracing, which means a material weakening of the structure.

Uncontrolled Pollution of Bogota Water Supply

Primitive Insanitary Conditions on Water Gathering Areas Cause High Typhoid and Dysentery —Chlorinators Recently Installed

WATER-BORNE typhoid and dysentery prevail to an alarming degree in Bogota, Colombia. Recently George C. Bunker, physiologist to the Panama Canal, investigated the five water supply sources of the city. He installed chlorinators on four of the supplies and exacted a promise from the officials of the Board of Sanitation to complete the installation on the fifth, which Mr. Bunker was unable to do because of a month's illness from the disease he was attempting to combat. Extracts from Mr. Bunker's report to the Board of Sanitation and other observations made by him follow.

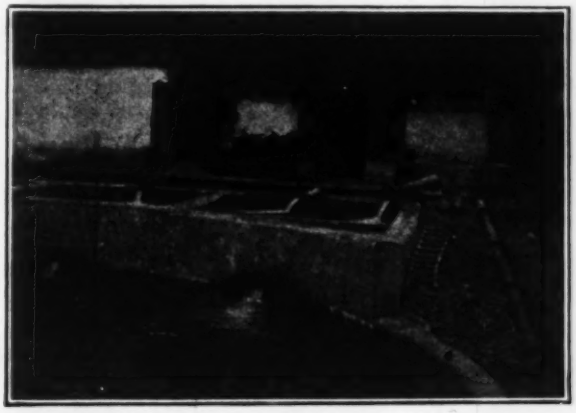
Water is supplied to the city from five sources, two of which are small rivers while the other three are still smaller streams. The water from each source flows by

INDEPENDENCE PARK, CATHEDRAL, MONSERRATE HILL
From 600 to 2,000 people visit this church every Sunday. Although located on watershed of city supply no public conveniences exist. Typhoid is continuous in consequence.

gravity into the distribution system. Tanks are provided for only two of the supplies. During the rainy season the water in the districts supplied by the two rivers is necessarily dirty because no attempt is made to remove the clay. It is probable that one-third of the distribution system is in bad shape. The greater part of the mains as originally laid was rather thin spiral steel pipe, which has been in the ground long enough to become badly corroded, with the result that the water escapes when the pipes are under pressure and contaminated ground water enters when the pipes are empty or half full. The sanitary conditions in the two river drainage areas are very bad.

To observe conditions on the watershed of San Cristobal River, a trip was made over one of the roads near the stream; 52 persons and 42 burros, oxen and pigs were encountered in 35 minutes of riding over a short section. The road was spotted with the fæces of the different animals while those of human beings were observed along the sides. It is estimated that about 3,000 persons pass to market over this road each week and that practically the same number return. Such a wholesale pollution of this watershed and especially those portions close to the river constitutes a dangerous menace to the health of those people in Bogota who live in the district supplied by water from the Rio San Cristobal.

Along the short section of road traversed several points were noted from which the ground sloped so that a moderate or heavy rainfall would quickly wash all of the accumulated excreta directly into the river. Unfortunately



CHLORINATOR HOUSE FOR CHAPINERO SUPPLY
Chlorine is fed into discharge from conduit leading from stream to the storage tanks in foreground.

this river is a very rapid flowing stream which means that self-purification cannot be counted upon to remove any of the polluting material introduced into it.

The most glaring example of pollution and one which is well known by the public is that of the Rio San Francisco supply. Part of the area draining into this river is made up of the south and east slopes of Monserrate Hill on the top of which a church of the same name is situated. On every Sunday from 600 to 2,000 people visit this church and there are no privies or dry closets in the vicinity. Under the existing conditions excreta containing disease germs are continually deposited on Monserrate Hill and intermittently carried down into Rio San Francisco by the rains with the result that a sort of endless chain of infection exists. The

LAUNDRY LAID OUT TO DRY AFTER BEING WASHED IN STREAM SUPPLYING BOGOTA WITH WATER

pollution of Rio San Francisco by the excreta on Monserrate Hill furnishes the clearest demonstration of waterborne typhoid fever and dysentery which I have encountered in seventeen years' experience in water purification.

Lehigh University Plans Enlarged Facilties

President Richards of Lehigh University has announced a plan for the enlargement of the university facilities which calls for an expenditure of $11,758,000. This money is to be used in the establishment of the Lehigh Institute of Research and in erecting and endowing several new buildings. President Richards stated that Lehigh needs a new library and auditorium, a metallurgical laboratory, a mechanical and electrical engineering building, a marine engineering laboratory and naval tank, an hydraulic laboratory, a biological greenhouse, an infirmary and an armory.

Cloudburst Flood at Hot Springs, Arkansas

Rainfall of Five Inches in Two Hours on May 14 Overtaxed the Capacity of the Covered Channel of Hot Springs Creek in Mountain Gap Traversed by City's Principal Street

BY JOHN R. FORDYCE
Consulting Engineer, Hot Springs, Ark.

ABOUT five on the afternoon of May 14 a cloudburst flood swept from the sides of the hill down into the valley in which is situated the city of Hot Springs. This flood is of a special interest to engineers because of the fact that the original channel of the small stream which drains the mountain area is covered by an arch roof along the narrowest part of the valley and the city's street is directly over its roof. The conduit proved entirely inadequate to carry the water. Pavements were torn up and wrecked, great property damage of other kinds occurred. Fire broke out and destroyed many buildings. The outstanding favorable circumstance was the fact that no lives were lost.

FIG. 1—LOCATION AND TOPOGRAPHY OF HOT SPRINGS—DRAINAGE FROM MOUNTAIN VALLEY PASSES THROUGH COVERED CHANNEL UNDER CITY STREET

The Flood Rainfall—It had rained off and on since one o'clock in the morning of the fourteenth. The government gage at 9 a.m. on the 14th showed 2½ in. of water. There were showers during the day and about 4:30 p.m. it began to rain much harder. An observer reports that at 5:30 the water was curb-high in the streets; at 6 it had gotten over the sidewalks and was beginning to enter the stores, whose floors were about twelve inches above the sidewalk, and at 6:30 it was a foot deep in the stores; at 7 the doors of the store fronts were broken in, and at 8 o'clock it was almost shoulder-high in the more restricted area. From then on the water began to recede, and by 11 p.m. it was not more than knee-deep in the streets.

Toward evening a fire broke out in the central part of town, from lightning. As it was impossible to reach the fire plugs the whole block was destroyed, except for the fireproof Citizens National Bank.

Weather Bureau Data—Data on the rainfall are given by P. P. Patraw, co-operative observer of the Weather Bureau, in the following special report:

The storm hit here and it started raining at about 1 a.m., May 14. At 8 in the morning the heaviest part of this storm had passed and it was raining lightly. At 9, when I took measurements, the fall amounted to 2½ in. The rainfall the rest of the forenoon was light.

Another storm started in the afternoon. The force of the storm struck about four o'clock, reaching its height at about 5: 30, when the water was pouring from the skies in sheets. At this time the sky had a yellow or brown cast. The rain slackened to little more than a sprinkle at about 8, but in a half hour it began again to rain heavily and continued to about 10: 30, when it slackened to a light rain, the electrical storm having passed. Several persons told me of having seen hail, although I observed none, the stones varying in size from moth balls to hen's eggs.

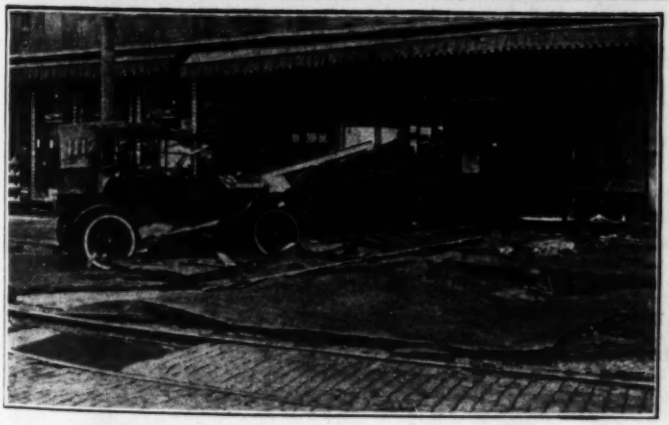
From observations during and after the storm, I am of the opinion that the storm was central over the northern part or more to the north of the city, 90 per cent of the flood waters shedding from Sugar Loaf, North and Hot Springs Mountains, coursing down Whittington and Park Ave. and Fountain St. into Central Ave.

No attempt was made to measure the rainfall at night. At 9 a.m. of the 15th, the gage measured 6½ in. since 9 of the preceding morning. Of this amount I estimate that 5 in. fell between four o'clock and six o'clock the evening of the

14th, and 1¾ in. between six and eleven o'clock, making the total rainfall between about one o'clock in the morning to eleven o'clock at night 9 in. It is possible that the gage, not being in the center of the storm, did not record the greatest amount of fall within the city or within the watershed flowing into Central Ave.

A good idea of the force of the current and its destructiveness can be gathered from the fact that midway of the bathhouse row, where the distance between the buildings is 120 ft., the water was 4 to 5 ft. deep and carried down automobiles occupied by people. These people were rescued and taken into the bathhouses along the row. The floors of these buildings were about four feet above the flood and formed places of refuge. Many automobiles which were parked along the curbs were driven by the force of the water through plate-glass store fronts and back into the buildings, wrecking the glass and showcases.

Topography—Hot Springs National Park embraces about 1,000 acres of hills and valleys surrounding the hot springs. These springs flow from the mountain in a small area of about ten acres. The 1,000 acres has been reserved by the U. S. Department of Interior as a national park since about 1833, this having been the first area in the United States set aside for park pur-



UPPER LEFT—VIEW OF HOT SPRINGS, LOOKING SOUTH
The character of the topography, inducing rapid runoff, shows flood dangers from excessive rain.

CENTER—PART OF THE BUSINESS DISTRICT BURNED

LOWER LEFT—DAMAGE DONE ASPHALT PAVEMENT
Note blocks between tracks have been carried away.

UPPER RIGHT—CAST IRON-BASE OF LIGHT POLE BROKEN BY IMPACT

LOWER RIGHT—WRECKAGE LEFT BY FLOOD
Height to which flood waters rose is shown by leaves, grass and debris caught on the door and radiator of the automobiles.

poses. Bathhouses are on one side of the principal street; the opposite side has been built up very compactly with modern business houses. At a distance of half a mile up the valley from the hot springs, the valley divides in two main branches, occupied by Park Ave. and Whittington Ave., and both these valleys are drained by large creeks. In addition there are numerous lateral ravines, all of which bring in their supply of water.

The total area in this drainage basin is approximately 4 square miles. The 9 in. of water which fell in this area completely filled the channel of Hot Springs Creek. This stream has been covered with an arch roof since 1883. The largest section of this closed conduit is 278 sq.ft. It is necessary to state that the sides of the mountain are wooded with pine, hickory and scrub oak. Clearing has been done, along the immediate side of ravines and streets. The slope of the hillsides is about 1 on 2.

Earlier Floods—This is the third flood in Hot Springs since the creek was covered. The first, shortly after the covering was completed, was not very serious and overflow of the streets resulted only because the upper part of the conduit became obstructed by small wooden bridges and other debris which washed down. One or two lives were lost in that flood. The next flood, in 1910, was very mild compared to the present. The water rose quietly in the streets and at no time was deeper than 3 ft. Photographs of that flood show people standing in the street and vehicles in water to the hubs. In the present flood, however, the greatest damage was done by the velocity of the water, whose destructiveness was greatly increased by cross-currents coming in from lateral ravines.

After the flood of 1910, Congress took notice of the situation at Hot Springs. A complete survey of the situation was made in 1912. The principal fact developed by this survey is that three engineering problems confronted the city of Hot Springs: (1) Provision of means to take care of unusual floods, (2) widening of the street or construction of side streets to take care of the increasing traffic, and (3) construction of a proper sanitary sewer system. In the report J. W. Barnett, consulting engineer, said that the sanitary conditions were most serious; nothing has since been done to improve them.

It will be seen from the map that the narrow street between North Mtn. and Hot Springs Mtn. and West Mtn. is the only means of communication between the north and south end of town and between the regions north and south of the mountains. It is almost impracticable to build a road across the mountain for several miles either side of the town.

Owing to the peculiar situation, it is not possible to deepen Hot Springs Creek. The masonry is laid in inferior mortar and would probably not survive the shock of blasting. But further, and most important to Hot Springs, is a fact which was not known at the time of Mr. Barnett's report, namely, the beds of shale on which the arch is constructed act as an impervious stratum which holds in the water of the hot springs and confines them in the highly cracked quartzite strata of rocks (it has been demonstrated by excavating for the various bathhouses that when this shale is removed the hot water from the springs escapes out of crevices in the quartzite, draining springs which are located higher up on the sides of the mountains). This fact alone will prevent the deepening of the creek even if other things were favorable. It would be impracticable to build a second conduit parallel to the present one because this would obstruct the traffic along the street, which is now very much overcrowded. The solution suggested by Mr. Barnett was the construction of a tunnel under the eastern end of West Mtn., to carry the water from the junction of the Park and Whittington Ave. creeks and leave the present conduit free to take care of the drainage from the North and Hot Springs Mtn. areas. This tunnelway might also serve as sanitary sewer, and could perhaps be doubledecked and made large enough to act as a roadway for excess traffic. It was estimated that the cost of all of this construction would be less than $500,000. The estimated damage to property and loss of patronage chargeable to last week's flood is estimated conservatively at $1,000,000, so that without a doubt the citizens of Hot Springs should take the necessary steps to prevent these floods in the future.

Because of the fact that the government controls the drainage area, and built the conduit which has now proved insufficient, the people here feel that the government should join them in any new construction work which may be necessary.

Pavement Damage—The upper part of Park Ave. is paved with wooden creosoted blocks on either side and bricks in the street-car width. Both the bricks and the creosoted blocks were torn up by the flood. Central Ave. was re-paved with asphalt in 1917. This pavement was entirely wrecked by the flood of the 15th; it separated from its base and was floated out of its place.

Future Railway Practice in England

Developments which are likely to take place in British railway practice as a result of the consolidation of all lines into four large systems are reviewed by J. F. Gairns in the *Railway Gazette*, London, and it may be that changes along somewhat similar lines will result in this country if the projects for railway consolidation should materialize. The following is a summary of the lines of development predicted:

1. Standardization of locomotives, not so much from the engineering point of view, which has already received attention, but because the new railways are so large that general availability on a wide scale will be essential.
2. Standardization of office methods, forms and returns.
3. Passenger fare standards, but with liberal concessions.
4. Freight rates will necessarily be standardized, and modifications will be made on systematic lines.
5. Economic study of all phases of railway operation.
6. General systematizing of train service schedules, though circumstances will always involve certain variations. The need for special fast trains will probably become greater, notwithstanding the fact that uniform train schedules are a desirable feature of economic train working.
7. Additional facilities for through and extension services beyond present frontier points of the individual systems.
8. Alternative routing, utilizing all possibilities afforded by the grouping of hitherto independent lines.
9. Considerable extension of through services and facilities between the companies, even though it will be possible to confine a large proportion of traffic within the limits of the new systems.
10. Signaling will be developed with greater freedom.
11. Electrification will be considerably extended.
12. The high-capacity freight car will gradually find its place, but mainly by the adaptation of traffic methods to suit it.

Marl-Sand Road Construction in Minnesota

Combination Compares Favorably with Sand-Clay —Dusting in Dry Weather Chief Drawback—Cost Reasonable

MARL, a soft earthy material composed principally of an amorphous form of carbonate of lime, of which there are many deposits in Minnesota, has been successfully used mixed with sand for surfacing roads in that state. So far sand-marl roads have been built only experimentally but this season several localities will adopt this type in their regular work. A full report on the laboratory studies and field experiments is published in a bulletin of the University of Minnesota Engineering Experiment Station by Charles H. Dow and from this the following notes are taken.

Final practice in experimental construction is exemplified by a 2,800-ft. stretch in Crow Wing County about 7 miles east of Pequot. This work is described and the conclusions from all three experiments are given as follows:

The road was divided into sections about 200 ft. long; 4 in. of marl, with 6 in. of sand were used for the greater part; 5 in. of marl and 7 in. of sand were combined on the steepest grade, and a skin coat of 2 in. was disked into a level stretch already comparatively firm. There proved to be little benefit derived from this last. The application of marl needs considerable depth of mixing to secure a thick, homogeneous crust over the sand.

Hauling and spreading began at the distant end of the section nearest to the pit, as wet marl is a difficult surface upon which to haul. Spreading followed on the next section beyond, making it necessary to haul through the loose material of the first section during the time it was being mixed. This did not develop any great difficulty, because a plow team was available to help, as it was occasionally needed. So the benefit of hauling over the smooth road as it was completed, section by section, was realized.

Hauling was done by team entirely, with pole-bottomed wagons. The haul varied from 2,000 to 6,000 ft. About 1 cu.yd. to a load was carried. There were several rains during the progress of the work. The marl was mixed with considerable difficulty, requiring repeated use of the spade disk harrow. Traffic cut in rather deeply, at first, but after a small amount of maintenance, the surface became smooth and rutless.

The method was determined by this experiment as follows:

1. Smooth the subgrade by a convenient method and bring it to a very low crown, say not over 3 in. for 20 ft. of width.

2. Spread one-half of the total amount of marl to be used over a width of about 2 ft. less than the proposed finished surface.

3. Thoroughly pulverize the marl as finely as possible with a disk harrow before plowing. If dry, tooth harrows may be used. Some marls are friable, and there a tooth harrow was very satisfactory.

4. Plow this marl coating under, setting the plow to elevate the required amount of sand to be mixed with the marl. This will vary with the kind of marl used, but will be approximately equal in amount. The first furrow should be started at the left of the center, throwing towards the center, and so on around, leaving at its completion, deep furrows at each side of the road.

5. Spread the remaining half of the marl.

6. Thoroughly pulverize the second coating of marl.

7. Plow three times more, the second plowing beginning at the outside and finally leaving a deep furrow in the center. The third plowing leaves furrows at the sides and the fourth plowing leaves a furrow in the center again. If the marl is very wet, it will be advisable to do some pulverizing between the plowings. Be sure the first plowing is not deeper than the ones following, so as not to lose any of the marl.

8. The last operation is to blade the surface to the proper crown and contour.

Maintenance should fill the ruts two or three times in the first few days. Light blading appears to be best for this purpose. The crown should be kept low. In fact it was kept flat on the 12-ft. width.

Cost figures follow. This cost very closely approximates a reasonable charge for doing the work and may be considered typical on this class of road. The length in this case is 2,800 ft.

Shaping subgrade	$23.40
352 cubic yards of marl in pit at $0.10	35.20
Digging and hauling marl	238.20
Spreading	50.85
Mixing marl with sand of subgrade	40.50
Rental of tools	3.00
Total	$391.15

The experimental roads were built during June and July and have been held under observation until the last of October. This has carried them through long dry periods, the most trying time for marl roads. Although this period of observation is not long enough to justify ultimate conclusions, certain deductions seem warranted and appear definite enough to record.

As a slab to bear up the weight of traffic against breaking through into the subgrade, the marl-sand surface has proved entirely satisfactory.

The surface has withstood heavy rains without noticeable injury. Beyond a certain amount of absorption, it seems to be impervious to water. In fact, the road seems to thrive on moisture.

The application of a uniform coating over the width of the road, with a very low crown, seems to be confirmed in principle, the idea being to induce traffic to use the full width of the roadway, preventing ruts and concentrated wear. Therefore, a feather-edge application would be insufficient.

After protracted dry weather and under heavy traffic, the surface becomes very dusty, this dust being somewhat more offensive than the ordinary kinds. Light traffic produces little or no dust, even during protracted dry weather.

We may say that, for light traffic, the surfacing of a sand subgrade with marl-sand surface is satisfactory from every standpoint, compares favorably with other forms of treatment, and is a great improvement over the loose sand through which it is built. The surfacing promises to be durable and permanent under such traffic.

Moderate traffic will require surface treatment on account of the dust nuisance. The blanket of fine gravel, of not over an inch in thickness spread over about two-thirds the width of the roadway, has been entirely satisfactory for this purpose. Calcium chloride serves the same purpose during its life, perhaps even better. Because marl holds moisture well, the applications seem to be effective for a long time.

Under heavy traffic, disintegration by dusting in dry weather will be rapid without surface protection. Our gravel blanket must be thicker and we shall then have in effect a gravel road upon a base course of marl-sand. There are indications that this combination is almost ideal because of the freedom of the marl-sand from waves and surface pockets. Only a moderate thickness and width of gravel are necessary, as it does not need to contribute structural strength, in addition to the marl slab beneath, and occasional travel at the extreme sides will be well taken care of by the marl.

Comparison was made in the laboratory of marl with clay. Where clay is available and it can be combined in accurate proportions with sand as a surface mixture, it is probably superior to marl. Pit clay varies greatly in its sand content and is difficult of manipulation in surfacing. Clay is at its worst in wet weather and at its best in dry weather. Contrasting the qualities of clay with those of marl that have been set down, we may say that marl compares very favorably with clay and is superior in some respects as a surfacing material for roads.

Building a Gravel Retaining Dam by Dragline

Low Concrete Dam on Porous Bottom Has Flexible Concrete-Block Apron—Built in Halves in Cofferdam

By C. H. Eiffert

Maintenance Engineer, Miami Conservancy District, Dayton, Ohio

A CONCRETE dam has been built across the Great Miami River at Hamilton, at the upstream end of the local river improvement of the Miami Conservancy District, to prevent the drift of gravel into the improved channel and thus reduce the cost of maintenance work. Immediately above the dam the Hamilton Gravel Co. has a cableway extending across the river and excavates gravel continuously from the channel, so that the material held back by the dam is not likely to accumulate to a troublesome degree.

The dam is of the overflow type and rests on a porous foundation of well graded gravel, varying in size from ordinary sand to boulders more than a foot in diameter. The length between abutments is 801 ft. and the height above the stream bed from 5 to 9 ft. A continuous cut-off wall of steel sheet piling 8 to 12 ft. in depth is provided at the upstream end.

FIG. 1—EAST HALF OF DAM

Stream diverted through openings for construction of west half. Excavation in west cofferdam in progress. Cable on side of stringers provided to hold deck together in case of washout. On Sept. 3 the deck was swept off by high water and drifted to the bank, being saved by the cable.

An interesting feature in the design of this dam is the use of a flexible apron of concrete blocks. These blocks are the same as those used by the District for the flexible revetment on channel improvement described in *Engineering News-Record* of Aug. 12, 1920, p. 292. The blocks are held together by ½-in. galvanized cables which have their upstream ends embedded in the monolithic apron. The downstream ends of the cables are held in place by concrete blocks 18 x 24 in. x 6 ft., cast in place. In case scour occurs at the lower edge of this apron, settlement of the apron will take place and continue to a depth at which no further scour will take place.

The principal feature of interest in connection with the actual construction was the use of a dragline excavator mounted on caterpillars for excavating, building cofferdam and driving piling. This machine started work at the east end of the dam and worked forward to the middle of the dam, the river still flowing in its low water channel to the west of the cofferdam. An 8-in. electrically driven centrifugal pump, running about half the time, kept the excavation free from water. The method used in driving piling was the same as that used on the Black St. bridge (*Engineering News-Record*, July 21, 1921, p. 120). The east half of the dam then was concreted, except for five 24-ft. openings, and its block apron was placed. When this work was completed, the dragline, which meanwhile had been used on other work of the District, returned and removed the cofferdam, diverted the stream through the five openings, and proceeded with excavating, building cofferdam and driving piles for the west half of the dam until its completion.

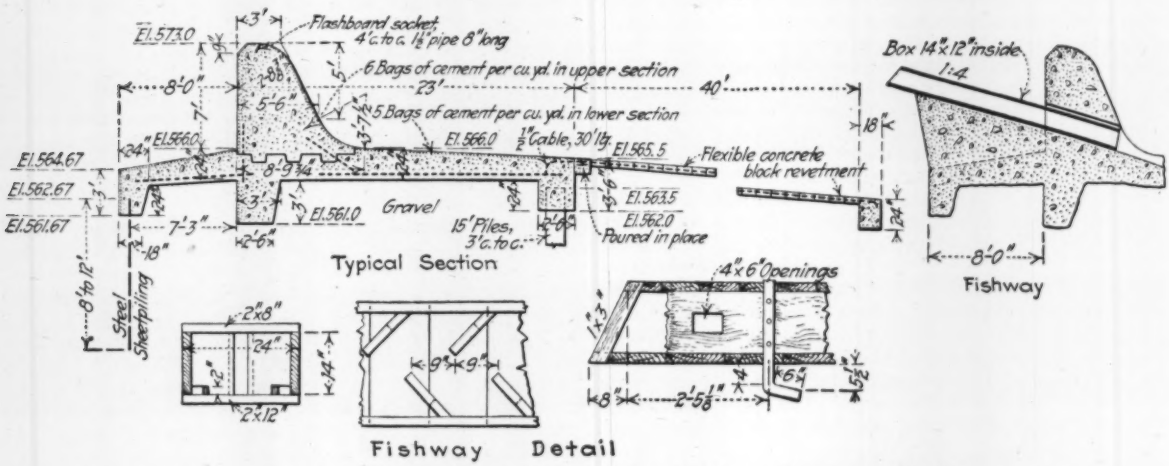


FIG. 2—DETAILS OF CONSTRUCTION OF DAM, APRON AND FISHWAY

For the purpose of delivering the concrete to the dam a trestle was built just above the face of the dam, the top of rail being about 2 ft. above the crest of the dam. Piles for this trestle were driven by the dragline as it proceeded with the other work. A concrete car with side door was built and the concrete delivered to the dam by a 3-ton Plymouth gas locomotive.

The dam was poured in 30-ft. sections except where the 24-ft. openings were left. The aprons and portion below the dam proper were poured in one run and fol-

lowed by the dam proper. The two runs were connected by keys and ¾-in. steel stubs 4 ft. long, set 18 in. center to center.

When the body of the dam was completed the five flow openings were filled, one at a time, beginning with the most westerly. They were closed by 8 x 16-in. timbers offset far enough from the face of the dam to leave room for building forms, and were made tight with earth and manure. When the last opening was to be closed the flow was only 8 in. in depth and amounted to 58 sec.-ft. This small discharge was due largely to the fact that the principal part of the flow was being utilized by the hydro-electric plant of the Ford Motor Co., whose tailrace discharges below the dam.

After closing the last opening it required 60 hours for the water to rise to the top of the dam. This was sufficient time to complete the forms, pour the concrete and remove the forms. On this section a hand pump was used to remove seepage water between the 8 x 16-in. timbers and the forms until the concrete had become set.

Work on the dam and abutments was started June 6 and completed Nov. 9. The concrete amounted to 3,400 cu.yd.; 16,000 blocks were laid in the apron. Work is now in progress on the revetment downstream from the abutments.

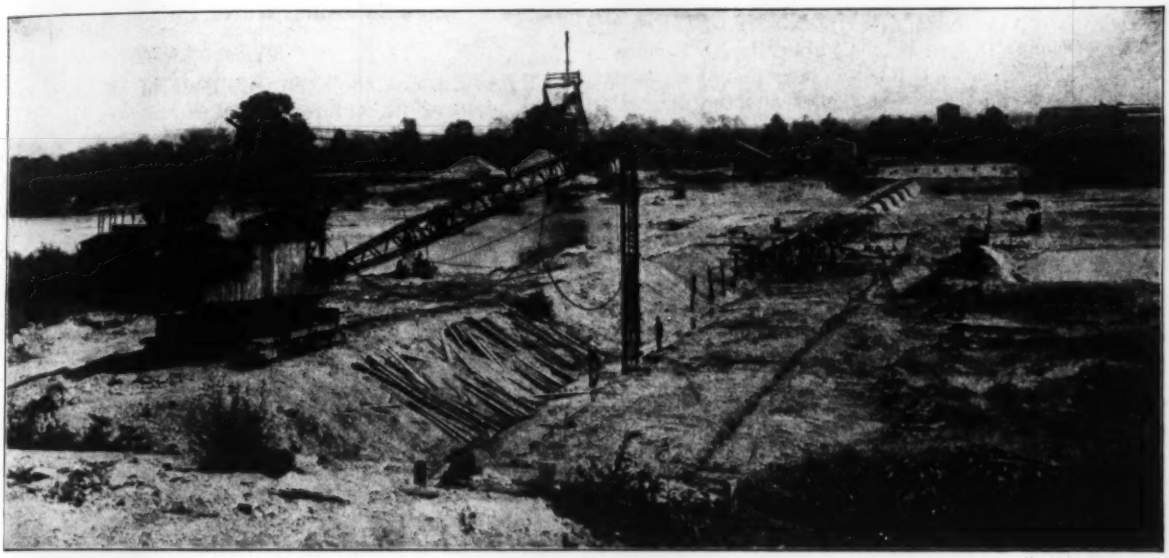


FIG. 3—ARRANGEMENT OF CONSTRUCTION PLANT

East half of dam completed; dragline driving steel sheeting in west half. Toe piles already in place. Gravel and mixing plants in background. Concrete trestle being extended to west. Drainage pump at right.

Paris Plans Moving Underground Sidewalk

Of thirteen plans submitted for the proposed underground moving sidewalk for Paris, five will be retained for experiment, according to *The Engineer*, London. These five will be tested over a circular distance of 300 m., in two groups. The four plans of the first group are based on the principle of parallel bands at graduated speeds, enabling passengers to step from one band to another until the most rapid is reached; landing places would be alongside the slowest band. The fifth plan is based on the idea of variable speed, slow movement at stations and higher speed between stations.

An English Rail Failure

IN A rail-failure accident on the London & Northwestern Ry., England, on Oct. 30, 1922, inadequate track inspection was a contributory cause, according to the government report recently issued. The engine of a passenger train from Blackpool to Manchester, running at 40 m.p.h., was derailed but fortunately there were no casualties. The accident occurred near Moorside, on one of the fast tracks of a four-track line. This track was laid in 1912 with 96-lb. bull-head 45-ft. rails secured in 56-lb. cast iron chairs by tapered oak keys or wedges, each chair being fastened to the tie by two spikes and two trenails. The joints were spliced by short bars with four steel bolts having self-locking nuts. In the entering end of one rail the second bolt had dropped out of place some time before the accident occurred but neither the section foreman nor his assistant in walking the track had noticed a loose nut or missing bolt.

The report states that the men employed as trackwalkers were accustomed to walk diagonally from one track to another instead of taking the full length of each track, although this practice gives ineffective inspection because not all the space is covered, and is dangerous to the men.

At the bolt hole thus left empty there was an old fracture in the web, extending back from the hole, and it is considered that the impact of the first truck wheel of the engine broke off the end of the rail, there being two new fractures running upward and outward in opposite directions from the bolt hole. The old crack was concealed by the splice bars. Tests and chemical analyses of specimens from the end of the rail showed that both the chemical and physical conditions were satisfactory.

It is stated that for twenty-one years up to Dec. 31, 1921, only three accidents on English railways had been caused by broken rails. In 1922 two such accidents occurred.

Phenol Contamination of Public Water Supplies

Menace in Byproduct Coke Oven Areas Considered at Conference Called by Public Health Service—Preventive Measures

THE INCREASING contamination of public water supplies by phenol from byproduct coke ovens, gas works, and possibly from plants manufacturing tar products, was the subject of a conference in Washington on May 18 following the annual conferences of state sanitary engineers, and state and territorial health officers. The phenol conference, called by the surgeon general of the Public Health Service, had as its chairman Dr. A. M. Stimson, director of scientific research, Public Health Service, and was attended by state health officers, state sanitary engineers and representatives of the Bureau of Mines and other federal bureaus.

Dr. Stimson exhibited a spot map showing the results of a questionnaire sent by the Public Health Service to state health officers asking whether they had experienced phenol troubles. The replies and the discussion at the phenol conference showed water contamination in New York, Pennsylvania, West Virginia, Ohio, Indiana and Illinois, with much likelihood that, unless controlled, trouble would extend materially in those states and in the central western states generally on account of the prospective multiplication of coke ovens.

W. H. Dittoe, chief engineer of the Ohio State Department of Health, said that every city that takes its water supply from the Ohio River, from East Liverpool to Cincinnati, has phenol trouble from time to time, as do some cities on the Mahoning River, and also Cleveland, Loraine and Elyria. The phenol taste is brought out by water chlorination. It is a health concern because it may cause a lowering of the rate of chlorination or even shutting off chlorination, with corresponding loss of protection to health. One Ohio city has had to abandon chlorination. Every Ohio city using the Ohio River is prepared to shift from chlorine to excess lime treatment. It was further brought out by Mr. Dittoe and others that the phenol contamination may force cities to use water of poorer quality from other sources and individual water consumers to resort to local wells, which latter may be polluted.

Prevention—Preventives for phenol troubles were also discussed at the meeting. These fall into attempts to prevent the discharge of phenol-loaded ammonia-condensation wastes into waters used for public supply, and attempts to remove phenol. The latter has been accomplished at some plants by using the condensation wastes in the coke-quenching pits. One speaker said that this had been held to be objectionable because it colors the coke and another speaker cited odor troubles as resulting from the practice. As to legal action, the attorney general of Ohio has ruled that the health authorities of that state cannot bring legal action under police powers because no damage to health has been proven, but several speakers expressed the belief that court relief could be secured under some line of action in view of the threatened menace to public health along the lines already indicated. The Cleveland City Council has passed an ordinance aimed against phenol contamination, which is serious there because a considerable part of the city cannot be supplied with filtered water until projected additional filters are built, thus making chlorination the only protection.

In closing the discussion Dr. Stimson expressed agreement with Dr. Bain of the Bureau of Mines who had called attention to the industrial importance of the coking interests and had urged co-operation with the industry. Dr. Monger, health commissioner of Ohio, moved that it was the sense of those present that the Public Health Service be requested to investigate the public health aspects and the Bureau of Mines the economic phases of the problem. This motion was adopted.

Sanitation of Water Supplies Main Topic of Conference

State Sanitary Engineers and Public Health Service Men Discuss Activities and Problems—New Treasury Water Standard

Engineering News-Record Staff Correspondence

WATER was the dominant topic of the four sessions of the conference of state sanitary engineers held at Washington, D. C., May 16 and 17. Many other activities of engineering divisions of the state health departments were discussed but none so extensively as the sanitation of public water supplies. The Treasury standards for drinking water on interstate trains and vessels received much attention, the discussion on this subject being opened by Surgeon A. J. McLoughlin, of the U. S. Public Health Service. The conference approved a tentative draft of new bacterial standards prepared by a sub-committee of the surgeon-generals advisory committee of 42 which is considering the Treasury standards in all their aspects. The business proceedings of the conference are reported in the current news section. A summary of the technical proceedings follows:

Revision of Treasury Water Standard—Of the three divisions of the new standard—bacterial, field survey and chemical—only the tentative draft of the subcommittee report on bacterial index was officially before the conference. That report, as submitted by Abel Wolman, of Maryland, proposes to rely solely upon B. Coli as the index organism; that is, it omits the total count. It would fix 10 cc. as the *standard portion* and five such portions as the *standard sample*, and provide that not more than 10 per cent of *all* the 10 cc. portions examined should show B. Coli, with more detailed provisions to cover both high and low total numbers of samples collected. In cases where about 100 portions of water are examined this 10 per cent limit would imply a probable density of about one B. Coli per 100 cc., but would permit *some* of the portions to run to 3, 5 or 10 B. Coli per 100 cc. It should be understood that the use of the 10 cc. portions is for water of approximately standard quality and does not preclude taking smaller portions of water that is highly polluted.

There was an apparent unanimous endorsement of B. Coli as the sole bacterial index in the Treasury standard but some questioning as to details of its application. Finally, the report was endorsed by the conference. No data on the proposed chemical standards were submitted. Considerable discussion on the proposals for field survey standards that have been circulated for purposes of criticism indicated that no

approach to finality here has been reached and that the subject seems complicated and beset with difficulties.

Collection and Shipment of Water Samples—A. N. Holmquist, New York, stated that water analyses are not made unless the local health officer says a question of health is involved. The sanitary division interprets the results of the analyses as made by the laboratory. There was a strong body of opinion on the one hand, that samples should be collected and shipped only by technically trained persons in connection with a field survey while on the other a number of speakers were apparently willing to rely upon local health officers and one or two thought that given proper printed instructions, good results could be had if samples were collected by laymen. The differences of opinion seemed to depend largely on available facilities, no one venturing to suggest that collection by a state agent, who would make a survey and transmit the sample to a state laboratory, was not the ideal plan. The need for a better container for shipping samples than any yet devised was voiced by several with no one maintaining that the ideal container is available. The need for improvement, however, seemed to be for something less expensive for shipping iced samples both to save outlay for containers and shortages at times of great sampling activity. The discussion indicated that existing conditions seemed to make it necessary in some quarters to ship bacterial samples un-iced.

Limitation and Control of Water Chlorination—In behalf of a committee on the subject of limitation and control of water chlorination, Abel Wolman, of Maryland, submitted a report in the course of which 50 p.p.m. of turbidity was the only specific limit to chlorination without other treatment that the committee recommended. It was felt that data are lacking for setting limits either as to bacterial load or organic content of the water, although both are highly desirable. The committee urged duplicate equipment for chlorination or where not feasible, then duplication of those parts most likely to break down. Finally, the committee stated that the success or failure of chlorination depends more upon the human element than on either the process or the equipment. E. S. Tisdale, of West Virginia, said that all men in charge of chlorination in that state are provided with turbidimeters and also with color standards for chlorine dosage. A majority of the 61 chlorinating plants in West Virginia are now in charge of Grade A operators and have duplicate spare parts if not entire equipment. A. N. Holmquist said that one operator in that state who has water of high organic content reports that he can chlorinate it up to 15 p.p.m. of organic matter. The report of the committee was adopted and the committee was continued.

Safe Loading of Water Filter Plants—A tendency to lessen expenditures for the operation of sewage works within the last few years was noted by Mr. Jewell, of Kansas, making it necessary to establish a factor of safety for water filter loading. W. L. Stevenson, of Pennsylvania, spoke of the shift in that state from pressure to secure sewage treatment to a drive for water purification with a recognition of sewage disposal by dilution as legitimate. Studies of loading of Ohio water filtration plants were noted by F. H. Waring, of the Ohio State Department of Health, and by H. W. Streeter, of the Public Health Service. These studies will be continued by the state and federal governments particularly along the Ohio River.

The activities of sanitary engineering divisions of state health departments were brought up by J. F. Jackson, Connecticut, and discussed at length under both this heading and under a committee report on laws, organization and policies. The consensus of opinion was that conditions existing in each state, such as relative needs for various lines of work, men and funds available, statutory authority and public opinion, should govern the range of activities of these divisions. The desirability of having the water and sewage laboratories under the direction of the engineering division was urged by some of the speakers. There was a diversity of opinion on whether the engineering division should make plans for sanitary works for other state departments, with an apparent leaning towards doing so except in the larger states where there are many institutions and a state architect, or similar officer in charge of design work for them.

In New York the state architect designs sewerage and water supply systems subject to the approval of the health commissioner who in turn relies upon the advice of state sanitary engineers. During this and other discussions engineers of at least two states expressed themselves, one for and the other as inclining to favor having state sanitary engineers pass upon plans for garbage disposal plants, the second speaker apparently basing his opinion chiefly upon economic grounds.

The conference requested the committee on activities to report an outline of what activities are considered necessary, what desirable, and what undesirable on the part of sanitary engineering divisions of state departments of health on mosquito control; a discussion on watershed control, led by Sol Pincus, until recently with the Public Health Service; and a discussion of the importance of statistical records correlating expenditures with resulting effects on specific communicable diseases —in the course of which one member told of the favorable impression made on a legislative budget committee by an exhibit of typhoid reduction since the establishment of sanitary control of water supplies. Well-water supplies were given considerable attention and the necessity for their chlorination in some cases was urged. There was a valuable paper on deep wells in which the importance of sealing the space between the outer side of the casing and fissured rock was urged, as also the sealing of the space between the inside of the casing and the pump barrel to prevent the admission of contaminated water.

Perpetual Logging Operation New Offer to Lumbermen

The largest body of fir timber ever put on the market by the Government is now being offered for sale, announces the Forest Service, United States Department of Agriculture. Ths timber, chiefly Douglas fit, totals 685,000,000 board feet and is only the first unit to be offered for sale in the Willamette watershed, which has a total of 4,500,000,000 feet of merchantable timber. The Forest Service plans to offer this timber at such a rate and under such conditions that a mill may be maintained there for all time. If the timber is cut at the rate of 50 millon feet a year it will require fourteen years to cut over this first unit, and at the end of that time succeeding units will be placed on sale.

Engineering Literature

A MONTHLY REVIEW OF BOOKS AND A LISTING OF NEW PUBLICATIONS

A Great Engineering Project

HISTORY OF THE BARGE CANAL OF NEW YORK STATE—By Noble E. Whitford, Assoc. M.Am.Soc.C.E., Assistant Engineer, State Engineer's Department. Albany, N. Y.: State Engineer and Surveyor. Cloth; 6x9 in.; pp. 610; halftones.

This book is a companion volume to Mr. Whitford's "History of the New York Canals," a too little known piece of engineering literature, which conceals under the forbidding cover of a state document a lively story of one of the most important engineering developments in history. The Erie canal and its companion waterways in the early days of the nineteenth century came at the beginning of the great industrial development of this country and were of and in that development. Their projection, design and construction are as important from a historical and economic as they are from an engineering viewpoint. The Barge Canal, on the contrary, has yet to justify itself economically, and for that reason the later volume is not so sound as its predecessor, for Mr. Whitford throughout takes the attitude of one who describes a successful fight of an entirely praiseworthy project against the forces of evil who would have prevented it.

The economic and chronologic history of the New York State Barge Canal is worth recording, though probably not in the detail given it here; but it is not altogether fair to write the history in the vein in which it has been written. So far there has been no proof that those who opposed the $101,000,000 proposition of 1901 (which has now grown to nearly twice that amount) were not justified in their opposition. Possibly time will prove the opponents wrong.

Mr. Whitford's story, however biased his attitude toward the canal, is a complete one. It is not intended to be an engineering description, except in generalities, for previous reports of the state have quite well covered the engineering details of the Barge Canal. It is a complete record of the political, legislative and administrative processes which led to the construction of the waterway.

Folwell's Sewerage Revised

SEWERAGE: The Designing, Constructing and Maintaining of Sewerage Systems and Sewage Treatment Plants—By A. Prescott Folwell, M.Am.Soc.C.E., Past President Am.Soc.M.I., Editor Public Works. Ninth Edition. New York: John Wiley & Sons. London: Chapman & Hall. Cloth; 6 x 9 in.; pp. 477; 80 line cuts and halftones. $4.

When the first edition of this book appeared, some twenty-five years ago, it contained little on sewage treatment. In the more recent editions that subject has been given additional space until now about 160 pp. are devoted to expository and descriptive matter, besides what the author seems warranted in believing to be by far the most complete list of American sewage-works ever published, a list by states, classified broadly by methods of treatment in use.

The chief if not the only material revision in the present edition is in the section on sewage treatment. Although that section presents an up-to-date summary of principles and methods it needs expansion in some details, particularly under the activated-sludge process. This latter section has only 3 pp. or but little more than the sections on the electrolytic and direct-oxidation (called by Mr. Folwell "direct-oxygen") processes, as against 2 pp. for the Miles-acid process, not yet permanently in use. Of the portions of the book not mentioned, about 200 pp. are given to design, 65 to specifications, etc., and construction, and 8 pp. to maintenance.

The fact that the book has gone to the ninth edition in twenty-five years is a good testimonial to its reception by engineers and the engineering schools.

Elementary Reinforced-Concrete Design

CONCRETE CONSTRUCTION FOR ARCHITECTS: A Concise Treatise on the Design of Reinforced Concrete Slabs, Beams, Girders, Columns and Footings, and a Description of the Actual Design of a Concrete Building Involving the Use of Flat Slab Construction—By DeWitt C. Pond, Author of "Engineering for Architects." New York: Charles Scribner's Sons. Cloth; 6x9 in., pp. 203; 89 line cuts. $4.

Except that the introductory chapter is so elementary in its treatment as to remind one of a bed-time story in the naïve manner with which the subject is approached, this book is a clear enough statement of the details of conventional reinforced-concrete building design. Nearly half of the book is devoted to detailed methods of working out the design of a large reinforced-concrete building in New York. The first part is, according to the subtitle of the book, "A concise treatise on the design of reinforced-concrete slabs, beams, girders, columns and footings." It would seem to an engineer familiar with the numerous books on reinforced concrete that an architect capable of understanding anything about reinforced-concrete design could get the information here presented out of any of the current engineering books, but an engineer is notoriously a poor judge of architectural mentality.

Production and Sale of Market Milk

MARKET MILK—By Ernest Kelly, in Charge, Market Milk Investigations, Dairy Division, Bureau of Animal Industry, Department of Agriculture, and Clarence E. Clement, Market Milk Specialist, Dairy Division, Etc. New York: John Wiley & Sons. London: Chapman & Hall. Cloth; 6x9 in.; pp. 445; 121 line cuts and halftones. $3.75. 18s. net.

Everything in the production and sale of market milk, from the cow to the consumer, is taken up in this volume. The book is written more from the viewpoint of the milk producer, jobber, and distributor than from that of the consumer and the public health officer, but in view of the many books treating the subject from the health viewpoint a volume concerned primarily with the business aspects of city milk supply is welcome; all the more welcome because it is for the public interest to have the "practical" and particularly the economic aspects of the milk supply set forth in so much detail as is here done.

After a brief review of the milk industry, milk as food and milk in relation to public health are considered. Equal space is given to the chemistry of milk, a few pages to milk bacteriology and 17 pp. to keeping down

the bacterial count. In more detail the authors take up organization of milk control, inspection, and scoring. Milk production cost, co-operative agencies, transportion, milk handling plants, pasteurization, mechanical refrigeration, and delivery to consumers are detailed. There are 26 pp. on distribution cost and 55 pp. of "Practicums," the latter being practical details, rules, and statistics.

The volume can be heartily commended to all who wish to know the details of milk production and the steps in its subsequent handling until delivered to the consumer.

Work Periods in Continuous Industries

THE TWELVE-HOUR SHIFT IN INDUSTRY—By the Committee on Work-Periods in Continuous-Industry of the Federated American Engineering Societies. With a Foreword by Warren G. Harding, President of the United States. New York: E. P. Dutton & Co. Cloth; 6x9 in.; pp. 302. $3.50.

For some years study has been directed toward devising means for doing away with the twelve-hour shift in the continuous industries without at the same time imposing an undue handicap. The first engineering meeting devoted to the subject was held in 1920, in Philadelphia, to consider the technique of changing from the two-shift to the three-shift system. Shortly afterward a study of the steel industry, made possible by a grant from the Cabot Fund, was conducted, and in 1921 a further inquiry under the same auspices took under consideration the problem with regard to the larger steel manufacturers in the United States. In that year also the Cabot Fund made a grant to the Federated American Engineering Societies to carry on two studies—one a general survey of the continuous industries, and the other particularly directed to conditions in the iron and steel industry.

The present volume presents the report of the Committee on Work Periods in Continuous Industries which directed these investigations. The general conclusion of the committee is that only a small part of industrial work, say 5 to 10 per cent, involves processes that require continuous operation, and the number of workers affected is relatively small. The desirability of abandoning the two-shift system, it concludes, lies not so much in the extent to which it prevails as in humanitarian considerations, along with the economic demand for that length of day's work which will in the long run effect maximum production. The weight of evidence, the committee reports, indicates that the change can usually be made at small financial sacrifice on the part of workers and of managements, and that under proper conditions no economic loss need be suffered. It is held that the change cannot advantageously be made by fiat and that to effect it suddenly or without adequate preparation will be sure to cause lowered production. On the other hand, the committee's judgment is that when the change is pre-planned and the co-operation of every one is enlisted, gains will accrue to all concerned—workers, managements, owners, and the public.

The general survey was conducted by Horace B. Drury and the investigation of the iron and steel industry by Bradley Stoughton, both of whom analyzed exhaustively the conditions that prevail in the fields assigned to them and the considerations that have led to the continuance of the 12-hour shift. Dr. Drury summarizes his conclusions as answers to the following questions: What is the extent of continuous work in American industry? What are the alternatives to the 12-hour shift? Are there technical difficulties in changing from two-shift operation? What are the factors to be considered in changing from two-shift to three-shift operation? How does the change from two-shift to three-shift operation affect the number of shift workers? What is the effect of 8-hour as compared with 12-hour shift operation on the quantity and quality of production, absenteeism, labor turnover, and industrial accidents? How do wage rates on 8-hour shift operation compare with wage rates on 12-hour shift operation? What is the general opinion of managers of three-shift plants regarding three-shift as compared with two-shift operation? Do employees make good use of the increased hours of leisure? To what extent have plants reverted to two-shift operation?

Mr. Stoughton concludes that the advantages to be derived from the employment of the 8-hour shift include increased efficiency, due not only to better physical and mental condition of employees but also to the appeal to a higher grade of men; better morale; elimination of the floating gang and a higher prestige for the employer with the general public, an asset that may be of considerable value during times of industrial controversy.

Made Better by Enlargement

ENGLISH AND ENGINEERING: A Volume of Essays for English Classes in Engineering Schools—Edited by Frank Aydelotte, President of Swarthmore College. Second Edition. Cloth; 6 x 8 in.; pp. 415. $2.

By adding to the number of essays the new edition of this useful and inspiring book has been made better than the first (see *Engineering Record*, Feb. 17, 1917, p. 275). The twenty-eight essays are grouped under: Writing and Thinking, The Engineering Profession, Aims of Engineering Education, Pure Science and Applied, Science and Literature, and Literature and Life.

Engineers are represented by J. L. Harrington, George S. Morison, A. G. Christie and J. B. Johnson. Among the other authors given a place are Ruskin, Arnold Bennett, Frederic Harrison, Louis D. Brandeis, F. A. Walker, Huxley, Tyndall, Matthew Arnold, Wordsworth, Stevenson, J. S. Mill, Emerson, Carlyle, and Macaulay.

Three objects of the volume as it now stands are stated by President Aydelotte (now of Swarthmore in the capacity indicated instead of being professor of English at M. I. T.) as follows:

> (1) To teach the student to write not by telling him how, not by doing his thinking for him, but by stimulating him to think for himself about his own problems, about his work and its place in the world.
>
> (2) To lead the engineering student to think of the occupation for which he is preparing himself not as a trade but as one of the liberal professions.
>
> (3) To lead him to see how his work of designing material conveniences for men is bound up with the spiritual advancement of the race—with the world of science, of literature and of moral ideals.

There are not many practicing engineers, it seems safe to say, who would not find it to their interest and profit to read this volume, even though it might be a matter of re-reading in the case of some of the essays. For engineering students the book deserves high commendation.

PUBLICATIONS RECEIVED

Notes on Pamphlets and Reports

A BULLETIN ON HIGHWAYS and one on MOTOR TRUCKS have been published by the Purdue University (Lafayette, Ind.). The first is on Fundamentals of Construction and Maintenance of Secondary Type Highways, by Charles C. Albright, professor of railway civil engineering, and is designed for the Engineering Extension Service. The second, on Truck Operating Costs, by Ben H. Petty, assistant professor of highway engineering, reviews cost factors and cost recording methods, including forms.

HYDROGEN-ION INVESTIGATIONS multiply. One of the latest to become available is An Experimental Study of the Relation of Hydrogen-Ion Concentrations to the Formation of Floc in Alum Solutions, by Emery J. Theriault, Assistant Chemist, and W. Mansfield Clark, Chief of Division of Chemistry, Hygienic Laboratory, United States Public Health Service. (Reprint from Public Health Report, Feb. 2, 1923; pp. 20, including diagrams and formulas.)

THERMAL STRESSES IN CAR WHEELS, by George C. Burgess, physicist, and G. Willard Quick, associate physicist, U. S. Bureau of Standards (Technologic Papers; pp. 37; illustrated, 15c.) summarizes tests on eight worn and eleven new steel wheels of five types of manufacture, in which the rims were electrically heated to 380 deg. C. to simulate service conditions under heavy brake applications.

THE MALARIA PROBLEM OF SOUTHEAST MISSOURI is reviewed by Dr. M. V. Ziegler and Dr. K. F. Maxey, U. S. Public Health Service, in Reprint 815, Public Health Reports (pp. 20).

MANY PAPERS ON PUBLIC BATHS and other matters related to public hygiene and recreation are printed in the 1922 *Journal* of the American Association for Promoting Hygiene and Public Baths (Arthur M. Crane, Manager, Nutley, N. J.).

INTERNATIONAL COURTESY is exemplified in Bulletin 217, U. S. Bureau of Mines (pp. 127; illustrated), on the Preparation, Transportation, and Combustion of Powdered Coal, by John Blizzard, "published through the courtesy of the Canadian Department of Mines."

THE GOVERNMENT SERVICE FOR WATER-POWER AND ELECTRICITY, Netherlands East India (Bandoenig, Java), has published its report for the year 1921. Besides 60 pp. of text, tabular summaries and diagrams it contains a colored folding map of Java showing its main rivers and power stations.

STANDARD METHODS OF MILK ANALYSIS, the collaborative production of the American Public Health Association and the Association of Official Agricultural Chemists, is out in a fourth edition (pp. 40; A.P.H.A., 370 Seventh Ave., New York City; 40c.).

PLANKTON AND RELATED ORGANISMS, by W. C. Purdy, Plankton Expert, U. S. Public Health Service, reviews biological investigations made in 1914-15 as a part of A Study of the Pollution and Natural Purification of the Ohio River (Public Health Service; pp. 78; line cuts). The studies as a whole, conducted under the direction of Surg. W. H. Frost, were interrupted by the war.

THE SCHOOL OF ENGINEERING RESEARCH, University of Toronto (Ont.), has issued Torsional Strength of Rectangular Sections of Concrete, Plain and Reinforced, by C. R. Young, W. L. Sagar, and C. A. Hughes (pp. 25; line cuts).

THE RESULT OF A YEAR'S TEST of a Hollow Tile and Concrete Floor Slab Reinforced in Two Directions comprises Technological Paper No. 220, U. S. Bureau of Standards (pp. 65; line cuts and halftones). The authors are W. A. Slater, engineer physicist, Bureau of Standards, and Arthur Hagener and G. P. Authes, engineers, Whitacre Engineering Co.

THE NOTABLE PAPER BY ISAAC S. WALKER, general manager New Chester Water Co. (Drexel Building, Philadelphia), on the Purification of the Chester Water Supply with Special Reference to the Pollution of the Delaware River, read last October before the Pennsylvania Water Works Association, may now be obtained from the author in pamphlet form (pp. 30). Among other things it gives float and bacterial observations to show the effect of the large volumes of Philadelphia sewage discharged into the Delaware above the Chester water intake. The conclusion, after considering the typhoid rates also, is that the sewage is nearly all destroyed and typhoid and other water-borne disease germs wholly destroyed by natural agencies before the intake is reached.

THE NATIONAL PAVING BRICK MANUFACTURERS ASSOCIATION (Cleveland, Ohio) has published the *Proceedings* of the Permanent Committee on Simplification of Variety and Standards for Vitrified Paving Brick of the U. S. Department of Commerce. The pamphlet contains relevant statistics for the years 1914-22 and minutes of meetings held Nov. 15, 1921, March 27, 1922, and March 27, 1923.

THE ENGINEERS CLUB OF PERNAMBUCO (Club de Engenharia, Rua 15 de Novembro, Pernambuco, Brazil) has started the publication of a bulletin. The first number contains, among other things, articles on the Pennsylvania tunnel beneath the Hudson River, New York City, and on the irrigation in the Piranhas valley.

UNDER THE TITLE, A Quarter Century of Cumulative Bibliography, 1898-1923, the H. W. Wilson Co. (New York City) describes its system of cataloging new books, with excerpts from reviews, and of indexing periodical literature. These useful services cover *Engineering News-Record*, the other McGraw-Hill papers and the books of the McGraw-Hill Book Co., besides the journals and books of scores of other technical publishing companies.

THE CONSOLIDATION OF RAILROADS IN THE UNITED STATES forms the 56th research report of the National Industrial Conference Board (pp. 107; 10 E. 39th St., New York City; $2). After sketching a historical background, proposed consolidations into nine systems are reviewed.

STATISTICS OF MANUFACTURES IN MASSACHUSETTS for 1920 covering 10,262 establishments, 695,832 employees and $4,370,276,822 of goods are presented, with text, in a 170-p. report just issued by the Department of Labor and Industries, Boston.

New Books and Revised Editions

BUSINESS CYCLES AND UNEMPLOYMENT. Reports and Recommendations of a Committee of the President's Conference on Unemployment, Including an Investigation Made Under the Auspices of the National Bureau of Economic Research. With a Foreword by Herbert Hoover. New York and London: McGraw-Hill Book Co. Cloth; 6x9 in.; pp. 405; diagrams. $4.

CIVILIZATION AND CLIMATE—By Ellsworth Huntington. Author of "The Pulse of Asia." Second Edition, with New Introduction. New Haven: Yale University Press. London: Humphrey Milford-Oxford University Press. Cloth; 6x9 in.; pp. 333; line cuts. $3.50.

CLIMATIC CHANGES: THEIR NATURE AND CAUSES—By Ellsworth Huntington, Research Associate in Geography in Yale University and Stephen Sargent Visher, Associate Professor of Geology in Indiana University. New Haven: Yale University Press. London: Humphrey Milford-Oxford University Press. Cloth; 6x9 in.; pp. 329; 13 line cuts. $3.50.

THE ENGINEERING INDEX, 1922—New York: The American Society of Mechanical Engineers. Cloth; 7x10 in.; pp. 675. $6. Over 600 periodicals, reports and other publications were selected from some 1,300 examined for the purpose of making up this volume, which is the 21st in the series and the 4th since the Index was taken over by the American Society of Mechanical Engineers.

FINANCIAL INCENTIVES FOR EMPLOYEES AND EXECUTIVES—Compiled and Edited by David Bloomfield; Introduction by Meyer Bloomfield. Two volumes. (The Modern Executive's Library.) Cloth; 5x8 in.; pp. 325 and 407. $4.80 for the two volumes.

Discusses types of wage systems, piece, day and week work, bonus systems, thrift plans, mutual benefit associations and pension systems, compensation for store, office and sales workers and for foremen and executives.

HIGHWAYS AND HIGHWAY TRANSPORTATION—By George R. Chatburn, Professor of Applied Mechanics and Machine Design, Lecturer on Highway Engineering, University of Nebraska. New York: Thomas Y. Crowell Co. Cloth; 6x9 in.; pp. 472; line cuts, maps and halftones. $3, net; postage extra.

HUTTE: Des Ingenieurs Taschen-Buch—Herausgegeben vom Akademischen Verein Hütte. E. V. In Berlin. 24 Auflage. I. Band. Berlin: Wilhelm Ernst & Sohn. Cloth; 5x7 in.; pp. 1308; 559 line cuts. $2 in Germany.
The 1923 edition of Vol. I of this well-known German handbook for engineers.

MAN AND CULTURE—By Clark Wilson, Ph.D., Curator-in-Chief, Division of Anthropology, American Museum of Natural History, New York City. (Crowell's Social Science Series.) New York: Thomas Y. Crowell Co. Cloth; 6x9 in.; pp. 371; 17 figures in the text. $2.75 net; postage extra.

MECHANICAL TESTING: A TREATISE IN TWO VOLUMES—By R. G. Batson, M. Inst. C. E., M. I. Mech. E., Associate of King's College, London, Senior Assistant in the Engineering Department of the National Physical Laboratory, Teddington, and J. H. Hyde, A. M. Inst. C. E. M. I. A. E., A. M. I. Mech. E., Senior Assistant in the Engineering Department of the National Physical Laboratory. Vol. II. Testing of prime movers, machines, structures and engineering apparatus. New York: E. P. Dutton & Co. Cloth; 6x9 in.; pp. 446; 313 line cuts and halftones. $10. The earlier volume, published in 1922, dealt with Materials of Construction.

OIL VALUATION AND TAXATION: The Federal Income Tax and Its Methods Applied to the Oil Industry—By Jas. I. Tucker, B.S. LL.B., Assoc. M. Am. Soc. C. E., Consulting and Appraisal Engineer, formerly Director School of Civil Engineering, University of Oklahoma. Author of "Contracts in Engineering." Houston, Tex.: Gulf Publishing Co. Flexible; 4x7 in.; pp. 332; two folding plates.

THE RIDDLE OF THE RHINE: Chemical Strategy in Peace and War—An Account of the critical struggle for power and for the decisive war initiative. The campaign fostered by the great Rhine factories, and the pressing problems which they represent. A matter of pre-eminent public interest concerning the sincerity of disarmament, the future of warfare, and the stability of peace. By Victor Lefebure, Officer of the Order of the British Empire (M.E.), Chevalier de la Legion d'Honneur, Officer of the Crown of Italy, Fellow of the Chemical Society, etc.; With a preface by Marshal Foch and an introduction by Field Marshall, Sir Henry Wilson, Bart., Chief of the Imperial General Staff. New York: E. P. Dutton & Co. Cloth; 6x8 in.; pp. 282; 5 halftone plates. $2.

SERVICE MONOGRAPHS OF THE UNITED STATES GOVERNMENT—Prepared by the Institute of Government Research. Baltimore: Johns Hopkins University Press. Cloth; 6x9 in. $1 each.
No. 4: The Alaskan Engineering Commission. By Joshua Bernhardt. pp. 124.
No. 17: The Federal Power Commission. By Milton Conover. pp. 126.
No. 16: The Coast and Geodetic Survey. By Gustavus A. Weber. pp. 107.
No. 23: The Office of the Supervising Architect of the Treasury. By Darrell Hevenor Smith. pp. 124.
Each volume gives the history, activities, organization and personnel of the branch of government treated, together with its publications, the laws under which it works, a financial statement and a bibliography.

THE SIGNIFICANCE OF THE FINE ARTS—Published Under the Direction of the Committee on Education of the American Institute of Architects. Boston: Marshall Jones Co. Cloth; 6x9 in.; pp. 481; 128 halftone plates. $3.50; or edition de luxe, $7.50.

STIMULATING THE ORGANIZATION—By Orline D. Foster. New York and London: Harper & Brothers. Cloth; 6x9 in.; pp. 414. $4.
Designed to stimulate production and sales.

VENTILATION: Report of the New York State Commission on Ventilation Appointed by the Governor of the State of New York at the Request of the New York Association for Improving the Condition of the Poor and Supported by the Milbank Memorial Fund, C.-E. A. Winslow, Chairman. New York: E. P. Dutton & Co. Cloth; 7x10 in.; pp. 620; 134 line cuts and halftones. $15.

Rail Joint Experiments in Europe

Extended experiments with rail joints of various types on the German railways indicate that the best design is the suspended joint, spliced with heavy bars and carried by ties placed as close together as will permit of proper tamping. This summary of the report of results is given in the *Revue Generale des Chemins de Fer*. In addition, a base support or bridge plate may be used, and it is noted that in any case the rails should be secured firmly to tie-plates which are attached to the ties by fastenings independent of the rail fastenings. With steel ties, a twin or duplex tie supporting both rails has been found satisfactory. Supported joints with a single tie or with a three-tie arrangement have not given good results. Numerous special joints of more or less complicated design were tested but all were abandoned as being inferior to well made joints of the ordinary type.

Letters to the Editor

This department aims to be a forum for the discussion of the views of engineers and contractors. The range of interest should be as wide as possible. Contributors are, therefore, asked to make their letters short.

For the Federation

Sir—Permit me to comment on the editorial in your issue of April 12, p. 652, relative to the vote of the Am. Soc. C. E. on the question of joining the F. A. E. S.

I held the position of vice-president of the F. A. E. S. for two years. I attended the organization conferences, every meeting of the Council and Executive Board, and all but two, I believe, of the meetings of the Committee on Procedure. I had an excellent opportunity to inform myself as to the ideas, opinions and ideals of the men in charge of federation affairs.

I wish to say that the following statement in your editorial is, in my opinion, grossly unfair. I never observed any such attitude and cannot imagine how such an impression could have obtained wide credence:

"For two years those behind the Federation have gone ahead on the idea that it was a perfected organization. Take it or leave it, they said in effect to the civils, all the time bringing to bear all possible pressure to make them take it."

On the contrary, it was thoroughly understood that the federation was not a perfected organization and that there was much room for improvement. As to "making the civils take" the organization as it stands, the charge is ridiculous. Those behind the federation have repeatedly stated to the civils that any amendments to the constitution presented by them if they came in, would be given full consideration.

You write: "It would be fair to start on the assumption that the civil engineers would be interested in a looser form of co-operative organization, one that is more representative and more responsible and which is neither so expensive nor so centralized as the F. A. E. S. has proved itself to be."

Let us see if this assumption is a safe one. The American Society of Civil Engineers had an equal part with other national engineering bodies in the development of the federation idea and in the framing of its constitution. It is equally responsible with the other societies for the "unrepresentative, unresponsive, expensive ($1.50 per year per member) and centralized" organization it has twice refused to support.

Civil engineers also are responsible in large measure for the "poor record" (sic) of the Federation. Twenty-nine members of the Am. Soc. C. E. have been members of American Engineering Council through their connection with other engineering societies. Included in the list are the council's two presidents, two vice-presidents, one treasurer.

In my opinion, the Am. Soc. C. E. has expressed itself most emphatically as being opposed to co-operation. It has acted most inconsistently by declining to participate in the most significant movement ever inaugurated looking toward the solidarity of the engineering profession—a movement in the inception of which it had a large part and for the management of which its own members are largely responsible.

Furthermore, the Am. Soc. C. E. has, by its adverse vote, expressed a severe indictment of the engineering profession. Included in the membership of American Engineering Council have been twenty-nine presidents and past-presidents of important national engineering societies. The Am. Soc. C. E. in supporting the "arguments against joining" the federation issued by its opponents has, in effect, declared that the most prominent engineers in the United States are unable to conduct their own affairs in a manner to inspire confidence in their fellows. If this be true, Lord help the profession's clientele!

W. E. ROLFE,
St. Louis, Mo., April 21, 1923. M. Am. Soc. C. E.

Floating Dredges and Land Dredges

Sir—With reference to the comparison of dredges of different types for drainage work, in *Engineering News-Record* of March 29, p. 579, in our experience we have found that walking dredges can be best adapted to the digging of small lateral ditches where the width does not exceed, say, 10 to 15 ft. When it comes to digging drainage ditches larger than this it seems that floating dredges can handle the work much more economically than any other type of equipment. Draglines are also used extensively for such work.

It is difficult to draw a distinct line of adaptation for all of these machines, but generally speaking it would seem that the small walking dredges could be used advantageously on small ditches wherever the banks are solid enough to sustain the weight of the machines. For the medium and larger ditches a floating dredge or dragline would be a better proposition.

HARVEY T. GRACELY,
Marion Steam Shovel Co.

Marion, Ohio, May 1, 1923.

Sir—The question as to floating dredges and land excavators for drainage ditches, suggested by the article in *Engineering News-Record* of March 29, p. 579, can be answered only in a general way, since there is merit in both dredges and dry land machines.

Local conditions govern the type of equipment most suitable. The design and dimensions would have to be considered also in order to properly equip any particular drainage ditch. On large projects where the land is covered with heavy timber a floating dredge is preferable; in fact, this is the only practical machine with which to do work of that character. For ditches where the land is not covered with heavy timber and on which the surface is reasonably solid to facilitate traction, a dragline machine equipped with either a walking device or caterpillar traction could be used successfully and profitably.

E. G. STERNBERG,
Sternberg & Horton, Drainage Contractors.

Chicago, May 10, 1923.

Sir—In the article on "Records of Walking Dredge Work in Delta Land Drainage," in *Engineering News-Record* of March 29, p. 579, it appears that the author missed the point in his effort to draw a comparison between the economics of floating and land dredges, in that he confined most of his discussion to the particular type of walking dredge which spans the ditch. The description of that type was interesting, but the limitations peculiar to any equipment which spans the excavation put it in a class by itself and should not be considered as applying to land equipment in general. As a matter of fact the "straddling" type is practically subject to the same degree of limitation as the floating type, but in the opposite direction, as the former can not dig a wide ditch and the latter can not dig a narrow ditch.

Conditions in the lower Mississippi delta are much more favorable to floating equipment than those described in the article referred to, as the large number of natural waterways forming a network through the country usually make it possible to move a floating plant from one job to another without dismantling and without the necessity of digging channels for which payment is not made. There are numerous dredges in operation in the vicinity of New Orleans which were designed for one specific job but which have worked on a dozen or more jobs scattered over a wide area; and there never has been any expenditure for moving from one job to another excepting towage bills in the canals, bayous and lakes. In spite of this, however, there is a growing demand for land equipment to meet local conditions which can not be handled to advantage by floating dredges. The land dredges used in this locality are mounted on skids and rollers or are of the caterpillar type, though the large levee-building machines are mounted on railway type trucks using single or double track.

New Orleans, La.
May 7, 1923.

ARTHUR M. SHAW,
Consulting Engineer.

Mackay Reservoir Seepage Records Bear Out Experimental Data

Sir—Your issue of April 26 contains an article dealing with seepage losses at the Mackay Dam on Big Lost River, Idaho, which is of special interest in connection with a paper on the same subject presented a few years ago to the Am. Soc. C. E., and reported in the *Transactions* of that society, Vol. LXXXI, pages 1 to 73. In the discussion of that paper at least two engineers, the writer being one, pointed out that on the basis of the tests then made, and assuming that the material under the dam was homogeneous and of the same character as that used in the model upon which the tests were made, the indicated seepage loss for a gage height of 100 ft. was 360 sec.-ft. Believing this result to be the clear indication of the test, and regarding such a loss as probably prohibitive, he suggested the possibility of an error in the test data as recorded in the paper, and called attention to the interest that would attach to actual records of seepage when they became available.

In the light of the actually measured seepage, now published for the first time so far as the writer is aware, it is of interest to note that by the same method that indicated a seepage loss of 360 sec.-ft. for a gage height of 100 ft. there would result indicated seepage losses of 112 sec.-ft. and 127 sec.-ft. for gage heights of 50 ft. and 55 ft. respectively, which agree closely with the observed seepage losses. For lower gage heights the agreement is apparently not so close, which, in the absence of complete data, can not now be accounted for.

As pointed out by several in the original discussion it is believed that more valuable information is to be obtained from a study of the performance of structures under working conditions than from a study of models, and in the present instance there seems to be an excellent opportunity for just such a study.

It is to be hoped that conditions since completion of the Mackay dam favor the securement of very accurate data as to quantity of seepage loss, zone of seepage loss upstream, zone of seepage recovery downstream, and other related data, for the varying storage depths under which the reservoir will be operated.

JOSEPH JACOBS,
Consulting Civil Engineer.

Seattle, Wash.,
May 9, 1923.

Operating Local Gravel Pits

Sir—The article in your issue of May 10 entitled "Operating Local Gravel Pits for Concrete Road Work" was of unusual interest to me, but it leaves the impression that the commercial producers of sand and gravel are excessive in their prices which, I am sure, is rarely the case, and although there was a very substantial saving for the state I am wondering if some contractor is not holding the bag. Of course the shipment of sand and gravel over fifty miles runs up heavy freight charges, which may have been the controlling factor in this instance.

Edmund Shaw with whom I am associated makes sand and gravel plants a specialty and in a number of instances the producers have sold their produce below production cost because they failed to give sufficient attention to the items of depreciation and amortization, both of which are large in the average gravel plant.

In regard to the statement of the county highway commissioner that the material was produced for about 70c. per yard, if a commercial producer allowed his production cost to reach such a figure he would be out of business over night.

From my observation the farther we get away from state or government control of manufacturing the more economical the production.

MELVIN E. HARTZLER,
Consulting Engineer.

Chicago, Ill., May 16, 1923.

News of the Week

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

News Brevities

By the Annual Report of the Southern Pacific Company a net income of $32,600,000 for 1922 as against $30,618,788 for 1921 is shown. This is at the rate of $9.47 a share on its capital stock.

The Dominion of Canada Has Authorized the construction of a new grain elevator at Montreal with an initial capacity of 2,500,000 bu. The elevator will be erected at Tarte pier by the Montreal Harbor Commission and is designed to have an ultimate capacity of 10,000,000 bu.

In Order to Meet the Needs of its growing export and import business the Southern Railway Co. has completed the dredging of the dock and approaches to its pier No. 4 at Pinner's Point, Va. The dredging operation has been carried out on both sides of the pier to a depth of 33 ft. at mean low tide, so that now the pier can accommodate four of the largest steamers using that port.

On May 16 the Interstate Commerce Commission began a hearing on the consolidation of the Eastern roads into several large systems, as called for by the Transportation Act. All the principal railways affected in this proposed consolidation will be given an opportunity to be heard on the question of the desirability of each tentative combination, or to propose others.

A Model Road is Being Constructed in Missouri on a four-mile stretch of the St. Charles road near Columbia by the Engineering Experiment Station of the University of Missouri. The most approved back-sloped, flat-bottomed ditch type road will be built. Manufacturers of material and road machinery are contributing equipment and operators.

Two More Railroads Have Succeeded in wiping out their deficits. The Nashville, Chattanooga & St. Louis reports a net income of $1,680,521 for 1922 as against a deficit of $259,801 for 1921, while the Chicago, St. Paul, Minneapolis & Omaha shows a net income of $1,177,929 as against a deficit of $285,671. The N. C. & St. L. RR. Co. at the same time reports that it will spend $1,225,000 on track and like improvements, and $2,500,000 on cars and locomotives.

An Immense Jubilee, in Which President Harding will be the central figure, is planned by the citizens of Alaska to commemorate the construction of the Alaskan R.R. by the U. S. Government. The railway, which is 467 miles long, was completed this month at a cost of $56,000,000. It is planned to have the ceremonies culminate in the driving of a gold spike by President Harding, either at the ocean terminal at Anchorage or at the great Tanana River bridge near Nenana.

Rutgers College Is Newest of Mines Bureau Stations

Rutgers College at New Brunswick, N. J., has been chosen as the location for the new mining experiment station for the bureau of Mines. The new station will specialize in problems involved in the production and use of the non-metallic minerals, and New Brunswick was selected as centrally located in the northern section which produces nearly all of the talc, three-fourths of the silica, nine-tenths of the slate, and three-fourths of the building stone of the country. The total production of non-metals north of the Potomac is $245,000,000, south of the Potomac, $92,000,000.

Concrete Test Road Stands Up Under 33,000 Trips

Thirty-three thousand trips have been made around the circular concrete track in the wear test being conducted by the Bureau of Public Roads of the U. S. Department of Agriculture and the first evidences of wear are just becoming noticeable.

On account of the manner in which the traffic apparatus is constructed 33,000 trips are equivalent to the passage of 66,000 trucks equipped with solid tires and so loaded that the weight per inch width of tire is 600 lb. The track is constructed of a number of different kinds of concrete and at the present stage of the test the wear is so slight that comparisons cannot be made between them.

New York Civil Engineers Elect Edwards President

At the annual meeting of the New York Section, American Society of Civil Engineers, on May 16, J. H. Edwards was elected president for the coming year, Allen Hazen vice-president, Prof. H. P. Hammond treasurer, and F. W. Scheidenhelm and Richard de Charms directors.

A special committee reported the results of an extended study of the subject of structural safety in building. The committee work resulted from an animated discussion of the subject at the section meeting of Oct. 18, when various proposals for reform in building methods were presented by members of the section. The report found none of the proposals satisfactory for acceptance, and recommended that building procedure be reformed by recognizing building to be a specialized technical activity involving a distinct hazard, and accordingly restricting it to architects and structural engineers as alone competent to carry it on. A method by which this might be done was presented in some detail. The committee also recommended that action to carry its recommendations into effect be initiated through the society. The subject is to be considered by the section further at a meeting early in the fall.

Construction Council Would Avoid Building Crisis

Board of Governors Urge Slackening of Work—Increase in Output of Materials Recommended

A program designed to avoid a crisis in the construction industry this year and to provide a foundation for a permanent plan to eliminate the danger of similar crises in the future was discussed at a meeting of the Board of Governors of the American Construction Council held in New York City on May 16 and recommended to the building public.

The sentiment of the Board representing all factors in the construction industry was unanimously favorable to the program which had been prepared by a committee appointed for the purpose by Franklin D. Roosevelt, president of the Council. This committee consisted of M. C. Rorty, president, International Telephone Securities Corporation; N. F. Hoggson, of Hoggson Brothers, New York; and John Donlin, president, the Building Trades Department of the American Federation of Labor.

Digest of Report

The report of this committee pointed out that the volume of construction projected so far this year exceeds the volume of the same period last year by more than 40 per cent and that the experience of 1922 demonstrated that during that year facilities for producing material and conducting field operations were taxed about to their limit. Construction work is limited not only by the available supply of labor and by inadequate transportation, but also by the restricted supply of manufactured products and materials produced by the basic industries which in turn are dependent upon the same factors. It related that stocks of materials on hand in practically all of the construction materials are lower than last year, while unfilled orders are greater. Recent figures, for example, show that orders on hand for common and faced brick are about 60 per cent higher and the stock on hand about 60 per cent lower than in 1922. Material prices are said to be rapidly rising and jobbers and manufacturers unable to maintain their quotations for more than a day or two at a time on certain products. The bidding of prospective buyers for material is sending prices upward and deliveries are becoming so uncertain that the practice of over-ordering for each job tends further to complicate the situation.

Labor rates also, the committee reports, are rapidly increasing, especially in the building trade. Employers are bidding for services and paying bonuses to an extent even greater, in some cases, than in 1920. Regardless of what opinions may be as to the reasonableness of a wage of $15 or $18 per day for skilled mechanics, the committee be-

lieves that under present conditions these scales will soon stop building operations and leave the laborer in a more unfavorable position than he would occupy under steady employment under a lower wage. The limited production capacity of many industries appears unable to meet a continuation of the present demand and even where plant facilities are adequate, the committee reports that output may be limited by labor and transportation.

The committee notes that to the credit of many manufacturers they have not only shown a desire to hold their prices within bounds, but have actually succeeded in doing it to a great extent. Cement and steel are notable examples of materials in which factory prices have been relatively stable. Whether the spread of prices between the manufacturer and the consumer is the result of speculation, local material corners or merely the unbridled bidding of buyers, is a matter that should be ascertained and made known to the public.

Course of Action Outlined

After discussing the various influences that might be set in motion to remedy these conditions, as, for example, the increase of production and the expediting of shipments and the elimination of restrictions on output on the part of local labor unions, elimination of which the committee reports would exert a significant influence in holding costs below that point where building becomes uneconomical, it outlined a second course of action which in its judgment should be invoked. These include publicity of construction costs so that the public may be enabled to follow the trend of prices and restricted demand at the point where investment becomes economically unsound.

The committee also declared that investment in new structures at an index number approximating 200 will unquestionably prove unsound in many instances when the general level of prices has declined. By informing the public of the index number from month to month it can govern its actions accordingly. It is suggested also that it may be possible to delay governmental, municipal and state construction until the peak of private building has subsided or until some curbing influence has been exercised on speculative building.

Other Remedies

Other remedies that are suggested by the committee include curtailment of speculation and over-ordering of materials on the part of dealers and construction companies by the establishment of bona fide material sale contracts obligating the buyer and seller to mutually advantageous positions. There is a big possibility, also, the committee believes, of controlling the situation to some extent through the steadying of prices by dealers and of wages by labor, but this, it believes, must come about as the result of mutual agreements between contractors, the building trade and those concerned with the handling of material. In order to bring about the necessary co-operation, the committee called upon one influence that can be brought to bear effectively, namely, the co-operation of the editors of the country. Publication of the construction index for the country or for a particular locality may call the attention of readers to the rising trend of construction costs and thereby effectively influence the demand.

As a preparation for steps to prevent future crises, it was decided at this meeting that the Department of Commerce should be asked to organize a statistical service that would gather and disseminate information as to construction, labor and material costs for the benefit of the general public and that if for any reason the Department of Commerce should not be able to do this that an investigation be made within the Council itself as to the practicability of its organizing and conducting such a service.

I.C.C. Commissioner Will Teach Transportation Course at Yale

In the selection of Winthrop M. Daniels, Interstate Commerce Commissioner, to occupy a chair in connection with its transportation course, Yale University has taken another step looking toward the ultimate realization of the Strathcona School of Transportation.

Mr. Daniel's work will be confined largely to public policy toward the public utilities engaged in transportation. This course of study will supplement those now being conducted by Prof. Dudley on the mechanical engineering side of transportation, and by Charles J. Tilden, professor of engineering mechanics, on highway transport.

Mr. Daniels' work will not be confined to public policy towards railroads, but will deal also with bus and truck transportation, electric railways, inland water transportation and transportation by air. In his second term, Mr. Daniels expects to take up a special course in the valuation of utilities and a course for graduate students on regulation of utilities.

Mr. Daniels' resignation as a member of the Interstate Commerce Commission becomes effective July 1. The President has designated Frank McNanamy as the successor to Mr. Daniels.

Delegates for Asphalt Conference on May 28 Are Named

At the general meeting to consider a reduction in varieties of asphalt for road work, to be held at 10 a.m. May 28 in the offices of the Division of Simplified Practice, Department of Commerce, Washington, D. C., the American Society of Civil Engineers has named as its representative Col. R. Keith Compton, of Baltimore, who will serve in a similar capacity for the American Society for Municipal Improvements. The delegate of the American Society for Testing Materials is C. L. Warwick. Representatives will be named this week for the American Association of State Highway Officials, the U. S. Bureau of Public Roads and the Chamber of Commerce of the United States.

State Sanitary Engineers Broaden Membership Basis

Chiefs of the sanitary engineering divisions of half the states in the Union and the three allotted representatives of the Public Health Service of the United States met in Washington, May 16 and 17 as the fourth annual Conference of State Sanitary Engineers. Subject to approval by letter ballot the conference voted to admit assistant state sanitary engineers as associate members, with all privileges except that of voting. It was also decided to restrict attendance at the conferences to the membership, except on invitation of others by the executive committee, and to give out to publications no papers or committee reports until after their presentation, nor until they have been reviewed by the executive committee.

Hereafter statistical reports will be submitted once in five years by these five committees: Water Supply, Milk Supply, Sewerage, Bathing Places and Mosquito Control.

The officers chosen for 1923-4 are: Chairman, W. H. Dittoe of Ohio; vice-chairman, H. F. Ferguson of Illinois; secretary, H. E. Miller of North Carolina. Future meetings will be held, as was this one, at the same time and place as the annual Conference of State and Territorial Health Officers.

Hughes Names Delegates to Navigation Congress

American delegates to the thirteenth International Congress of Navigation, which will meet in London in July, under the auspices of the Permanent International Association of Navigation Congresses, were named to-day by Secretary of State Hughes, following the receipt of an invitation from the British government.

The congress will deal with questions of inland and ocean navigation, largely from an engineering viewpoint. Membership of the United States in the association was authorized by Congress in the rivers and harbors act of 1902.

The American delegates, who were selected from government departments concerned with navigation, include the following:

Colonel J. C. Sanford, Corp of Engineers, U. S. A., retired.

Captain Frank T. Chambers, C. E. C., United States navy.

Colonel J. C. Oakes, Corps of Engineers, U. S. A.

Major O. N. Solbert, U. S. A., military attache at the American embassy in London.

Captain Charles L. Hussey, naval attache at the American embassy in London.

Rear Admiral William E. Reynolds, commandant of the U. S. Coast Guard.

John C Hoyt, hydraulic engineer, U. S. Geological Survey.

Colonel E. Lester Jones, director of the Coast and Geodetic Survey.

George R. Putnam, commissioner of lighthouses.

Walter Tower, commercial attache at the United States embassy at London.

Captain W. F. Purdy, operating manager of the U. S. Shipping Board at London.

Huntington T. Morse, European manager of the Emergency Fleet Corp.

Billion a Year for Rural Roads, Says MacDonald

New Figures Given at Road Builders' Annual Meeting—Frank Page Elected President

HITHERTO unpublished figures indicating actual expenditures of close to a billion dollars a year on the nation's rural highways and a summary of results of the detailed traffic census conducted in Connecticut through the joint efforts of the State Highway Department and the Federal Government were given out by Thomas H. MacDonald, chief, U. S. Bureau of Public Roads, at the annual meeting in New York, May 15, of the American Road Builders' Association. Present-day road-building efforts, viewed in the light of the amount of work to be done in the future, led Mr. MacDonald to remark: "We haven't even started to build highways in this country."

NEW OFFICERS

Frank Page, chairman, State Highway Commission of North Carolina, was elected president of the association and the other candidates for officers and directors on the regular ballot, including, as vice-presidents, E. L. Powers, W. F. Keller, S. F. Beatty and Samuel Hill, and, as treasurer, James H. MacDonald, were elected to office. By his election to one of the vice-presidencies of the association E. L. Powers terminates a service of 16 years as secretary; by action of the board of directors Ethel A. Birchland was named secretary pro tem. The newly elected directors are: J. R. Draney, New York; W. A. Van Duzer, Harrisburg, Pa.; Frank T. Sheets, Springfield, Ill.; E. J. Mehren, New York; I. W. Patterson, Providence, R. I.; Wm. R. Smith, Meriden, Conn.; H. K. Bishop, Washington, D. C.; J. H. Cranford, Washington, D. C.; C. M. Babcock, St. Paul, Minn.; H. S. Carpenter, Regina, Canada; S. T. Henry, New York; R. Keith Compton, Baltimore, Md.; Fred A. Reimer, Newark, N. J.; Charles M. Upham, Raleigh, N. C.; H. G. Shirley, Richmond, Va.; Will P. Blair, Cleveland, Ohio; Frank Terrace, Orillia, Wash.

FRANK PAGE

Reports received from the executive committee, the treasurer, and the Convention Committee, the latter accompanied by a financial statement audited by Haskins & Sells, certified public accountants, showed that the receipts from the sale of exhibition space at the 1923 convention in Chicago were $62,824.77 and the disbursements $56,332.81, leaving a profit of $6,491.96.

At the first meeting, May 15, of the new board of directors Chicago was selected as the place of the next annual convention and Good Roads Show, the dates selected being Jan. 13-19, 1924. The previous board had referred to the new administration a proposal made by the Highway Industries Exhibitors' Association to the effect that the exhibitors' association conduct the next Show, but in the name of the American Road Builders' Association, and turn over to the latter out of the profits a sum to be agreed upon to cover the expenses of running that organization. This proposal was amplified and explained by S. F. Beatty, president of the Highway Industries Exhibitors' Association and a vice-president, also, of the American Road Builders' Association. A discussion of the proposal followed, terminating in the adoption, unanimously, of a motion to the effect that the American Road Builders' Association should conduct the 1924 National Good Roads Show, but in so doing should seek the co-operation of the Highway Industries Exhibitors' Association. Authority for making detailed arrangements with the exhibitors' association rests in the hands of the executive committee of the American Road Builders' Association consisting of Thomas J. Wasser, S. T. Henry, and William R. Smith, with the president and treasurer of the association as members ex officio.

At the annual get-together dinner Toastmaster James H. MacDonald introduced the new president and after Mr. Page's address, Thomas H. MacDonald, of the Bureau of Public Roads, outlined the present status of the nation's roadbuilding program and its future development and told of the traffic census in Connecticut. Any consideration of our transportation problem, said Mr. MacDonald, must start with a realization that this country is organized on a basis of railway transportation for major movements. The total highway mileage in the United States was given as 2,800,000, of which about 180,000 miles, or 6.4 per cent, are at present included in the so-called 7-per cent federal-aid highway system authorized by the highway act of 1921. Figures recently compiled by the U. S. Bureau of Public Roads indicate expenditures for all purposes on rural highways during 1921 of $970,000,000, this figure being considered in excess of previous estimates based on incomplete data. Of this amount, less than half—or $450,000,000—was spent on state or federal aid work, indicating clearly, according to Mr. MacDonald, the need for the development of local organizations to handle large sums of money and provide adequate supervision of road construction. It was regarded as significant that after citing the great outlay being made for roads in the United States, Mr. MacDonald said: "I do not see any end to the road-building program. In fact, judged by the size of the task ahead of us, we haven't even started to build highways in this country."

In answer to the criticism of a railroad official who said recently that "there exists a positive mania for long distance roads, whereas lateral highways are our real need," Mr. MacDonald pointed out that of the 25,000 miles of federal-aid highway completed since 1916, only 26.8 per cent are of the heavy traffic type.

Among the interesting disclosures of the recent traffic census in Connecticut were that 35 per cent of all passenger automobiles are engaged on business trips, carrying an average of 1.7 persons as against three persons in cars on non-business trips. In general, the Connecticut figures prove, Mr. MacDonald asserted, that only an insignificant portion of the states motor truck traffic competes with the railroads.

A.G.C. Directors Adopt New Overhaul Specification

Station-to-Station Method of Yardage Computation Accepted for Road Work—Other Business

Directors of the Associated General Contractors of America, meeting in New York City, May 14 and 15, unanimously approved a station-to-station method of figuring overhaul for road construction, with 400 ft. free haul, and recommended that the association's committee on co-operation take up the subject with state highway officials. Station-to-station calculations, adopted in preference to the center-to-center and the mass methods of overhaul, are similar to the method used by railroads, but this is the first time that the system has been recommended for use in overhaul on highway work. The report accepted by the directors was prepared by J. H. Ellison, of Winston Bros., Minneapolis.

The directors pledged the co-operation of the membership with the managers of the Federation of Boys Clubs in an effort to have youths apprenticed in the building trades. Managers of the Federation, which includes 150 clubs in 110 cities organized somewhat along the lines of the "Big Brother" movement, at a recent meeting in Washington were addressed by Gen. R. C. Marshall, Jr., executive head of the Associated General Contractors, who pointed out that from the financial standpoint the tide of opportunity has turned from the white collar jobs to the crafts, and that some of the building trades now have only one-third the number of apprentices they had in 1919.

A resolution was adopted urging E. J. Russell of St. Louis to accept reappointment by the American Institute of Architects as a member of the National Board for Jurisdictional Awards. Mr. Russell has been chairman of the Board since its organization and recently announced his desire to retire with the expiration of his term this year, owing to the time involved in the Board's work.

George Griffith, Jr., of Los Angeles, was appointed chairman of the Highway Division of the Association, succeeding L. L. Rogers, resigned.

The directors approved a manual designed by headquarters to contain the various forms which are being evolved for contractors by the association. Reports were submitted showing wide interest in these forms, which include a standard equipment rental schedule, financial statement, job overhead and other features.

Considerable time was given to discussion of the heavy flow of contracts and difficulties of obtaining supplies of materials and in securing labor.

Denver Authorizes Bond Issue of $6,500,000

Bonds to the amount of $6,500,000 were authorized at a municipal election held in Denver on May 15. The proceeds will be used for extending and enlarging the distributing system, constructing a conduit from Marston Lake to Denver and building a filter plant. Burton Lowther is chief engineer of the Denver municipal water-works. Bonds are to constitute a lien on the system and are to be retired out of revenues from which will also come the interest.

Committee to Probe Coal Storage Is Named

F.A.E.S. Announces Plans and Scope of Investigation—Will Co-Operate With Federal Agencies

Announcement of personnel and plans of the committee which is to direct a national investigation of the storage of coal in co-operation with the U. S. Coal Commission, the Department of Commerce and the Bureau of Mines is made by the Federated American Engineering Societies. The committee members are:

H. Foster Bain, director of the U. S. Bureau of Mines, Washington; David Moffat Myers, former fuel administrator, New York; Perley F. Walker, dean of engineering, University of Kansas; W. H. Hoyt, chief engineer of the Duluth, Missabe and Northern Ry., Duluth, Minn.; S. W. Parr, professor of applied chemistry, University of Illinois; Edgar S. Nethercut, secretary of the Western Society of Engineers, Chicago, and Roy V. Wright, editor, New York. The chairman is W. L. Abbott, chief operating engineer of the Commonwealth Edison Co., of Chicago.

This main committee, it was stated by Dean Mortimer E. Cooley, president of the Federation, will work with committees in every state, studying local conditions through local engineers in an effort to find a solution for the problems of coal consumers from the small households to the largest industries.

Thirty national and local engineering societies, members of the Federation, have been enlisted in the work, and will be aided by other engineering groups, state administrative committees, federal and state agencies, private enterprises, civic bodies, corporations and individuals. The investigation, the first of its kind to be undertaken in this country, will deal with the whole range of problems affecting the storage of coal.

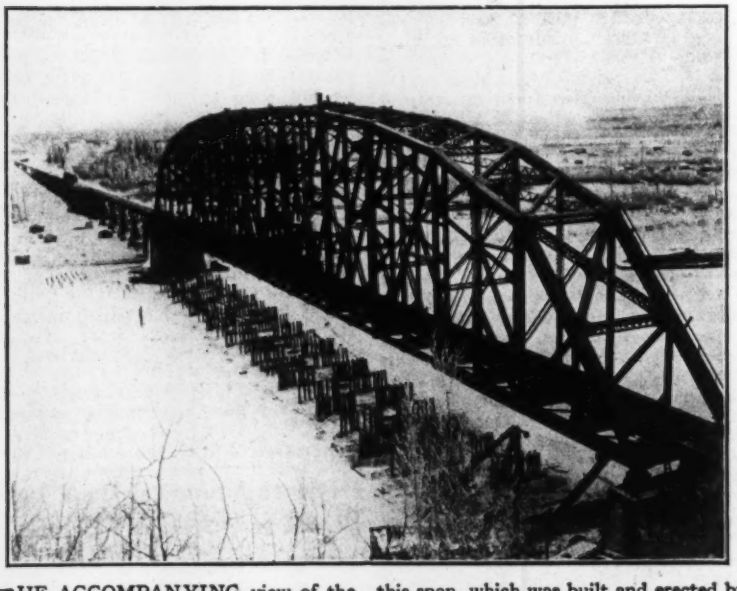
Factors involved, according to the Federation's statement, comprise cost, embracing the question of financing and providing means whereby coal in storage may be used as collateral; amounts of coal consumed at different periods, particularly by industries; provision by industrial organizations to aid the workers of the nation in securing coal supplies during the summer at a low cost; methods of handling and storing; effects of storage on the heating value of coal; transportation facilities; allaying labor unrest, and reducing the number of mines and miners.

The investigation is the third nation-wide inquiry to be conducted by the Federation as a part of its public service program, the other two having been the "assay" of the Hoover Committee on Elimination of Waste in Industry, and the Survey of the Committee on Work Periods in Continuous Industry resulting in the recommendation, endorsed by President Harding, of the adoption generally of the eight-hour day.

Michigan Central Improvements

Three principal works planned by the Michigan Central R.R. for the current year are: track elevation at Green St. and Central Ave., Detroit; nine miles of double tracking from Jackson, Mich., to Rives Junction, and completion of the large classification yards at Niles, Mich., described in *Engineering News-Record*, Jan. 8, 1920, p. 81.

Alaska Railroad Bridge Across Tanana River



THE ACCOMPANYING view of the 700-ft. truss span of the new bridge carrying the Alaska R.R. over the Tanana River was taken on Feb. 9, 1923, just after the span had been swung. The view is taken from the north bank of the river and the south approach makes a long loop to the right in order to pass through the City of Nenana on the south bank. About 2,380 tons of steel were required for this span, which was built and erected by the American Bridge Co. This bridge was described in *Engineering News-Record* of March 15, p. 476, in an article by Col Frederick Mears, U. S. A., chairman and chief engineer of the Alaskan Engineering Commission. The cover picture of the March 15th issue of *Engineering News-Record* shows the falsework for the steel span being erected.

Tests to Check Concrete Design Being Made

An expensive series of concrete strength tests on an actual building operation under the combined auspices of the Joint Committee on Concrete and Reinforced Concrete, the Portland Cement Association, the U. S. Bureau of Standards, and a committee representing the contracting industry has just been undertaken. In general the tests are to demonstrate the practicability under job conditions of the principles of concrete mixtures recently evolved in various laboratories.

The tests are to be carried out on an 8-story building operation which Stone & Webster, Inc. has under way for the Victor Talking Machine Co. at Camden, N. J. Delaware River aggregates, common to the Philadelphia market, will be used.

Strict water control which will be accomplished by accurate water measurement at the mixer, checked by slump and flow table tests, will be required. Numerous 6 x 12 in. cylinders three every hour of mixing time will be taken for 28-day, 90-day and 1-yr. breaks, which are designed to show the uniformity of strength obtainable with accurate water control under job conditions.

Another line of investigation requires the cutting of cylinders from actual structural concrete, to demonstrate whether molded specimens correctly represent the actual material in the building. It is also the intention to make several batches of especially designed proportions to test out the latest principles derived from laboratory investigation.

A comparison between field made and laboratory made concrete with identical materials is also to be made, as well as a thorough study of the cements used. The technique of job testing will also receive attention.

W. A. Slater, engineer physcist of the Bureau of Standards, is director of tests. He will be assisted by Stanton Walker, a concrete technician from Lewis Institute in Chicago, who is in direct charge of the field testing work. Richard L. Humphrey is chairman of the Joint Committee, and M. J. Whitson of Stone & Webster with M. M. Upson of Raymond Concrete Pile Co. are joint-chairmen representing the contracting industry.

Public Roads Bureau Tests Concrete Curing

Methods of curing concrete road slabs are being tested by the Bureau of Public Roads of the United States Department of Agriculture at its Arlington Experiment Station. About the middle of April a number of 6-in. slabs, beams for breaking by bending, and compression specimens were cast with 1:2:4 concrete using gravel aggregate. One set of specimens has been air cured while others have been cured under wet sand, wet earth, tar, asphalt, other coverings and frequent sprinkling with no cover.

Twenty-eight-day tests will be made on the bending and compression specimens and on cores cut from the slab and at frequent intervals additional compression tests will be made on cores from the slabs.

A progress report will be made within a few weeks.

South Dakota Has State Road Fund

A summary of the methods of financing highway construction, which was sent out recently by the American Association of State Highway Officials, embodied an error in stating that South Dakota depends entirely on its counties for highway funds. This misapprehension was made possible by the fact that the legislature in South Dakota makes no appropriation of road funds but the money collected for automobile licenses is handled as a state fund. Since the summary of the Association of State Highway Officials was made public, the South Dakota legislature has provided a state fund for road maintenance. The gasoline tax was increased so as to provide the money for that purpose.

Engineering Societies

Calendar

Annual Meetings

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION; Annual Convention, Ithaca, N. Y., June 20-23.

AMERICAN SOCIETY FOR TESTING MATERIALS, Philadelphia; Annual Meeting, Atlantic City, N. J., June 25-29.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York, Annual Convention, Chicago, July 11-13.

NEW ENGLAND WATER WORKS ASSOCIATION, Boston, Mass.; Annual Convention, Burlington, Vt., Sept. 18-21, 1923.

The Syracuse Section of the American Society of Civil Engineers, has elected the following officers: President, Louis Mitchell; vice-presidents, Glenn D. Holmes and Henry D. Brewster; secretary-treasurer, Henry G. Throop.

Personal Notes

A. T. CANFIELD, engineer, Kansas City Southern Ry., has accepted a position with the Cross-Widdell Engineering Co., Inc., of Kansas City.

ABRAM SWAN, JR., city engineer of Trenton, N. J. for many years, has been elected one of the city commissioners of that city to succeed J. Ridgway Fell, retired.

F. O. CONDON, formerly district engineer, Moncton, N. B., has been appointed engineer of maintenance-of-way, Canadian National Ry., Atlantic Division.

H. J. CRUDGE, formerly assistant engineer of bridges, has been appointed building engineer, Atlantic Division, Canadian National Ry., Moncton, N. B.

R. L. Rowland, former district engineer for the Portland Cement Association has resigned to enter the paving contracting field, with headquarters in Seattle. Mr. Rowland will be succeeded by H. M. Hadley.

STOVEL & BRINKERHOFF of New York City announce the addition of H. M. Van Gelder as partner and a change of name to Stovel, Brinkenhoff & Van Gelder, engineers and constructors.

CONSTRUCTION AND FOUNDATION CORP. announces its removal from 372 Lexington Ave., New York City, to 50 East 42nd St.

GEORGE G. HATTER, executive manager of the Pennsylvania State Highway Department, has resigned and, with George H. Biles who resigned from that department March 15, will do consulting engineering work.

C. E. RICE, city engineer of Wooster, Ohio, has been appointed city engineer of Massillon, Ohio, to fill the vacancy created by the death of Harold Howald.

F. J. BACHELDER, consulting engineer, removed his office on May 1 from 8 S. Dearborn St., Chicago, to Illinois Merchants Bank Bldg., that city.

LANE, DAVENPORT & PETERSON, architects and engineers, formerly at 2320 Dime Bank Bldg., Detroit, Mich., are now occupying their new offices at 1017-1020 Charlevoix Bldg., Park Blvd. and Elizabeth St., Detroit.

CHESTER G. WIGLEY, formerly chief engineer of the New Jersey State Department of Health, has opened at 2 East 23rd St., New York City, an office for practice as a consulting sanitary engineer, including designs, construction, reports and appraisals of water and sewage works.

L. S. COBURN has resigned from the North Carolina Highway Commission to become resident engineer with the Kentucky State Highway Department, and will be located at Morehead, Ky.

C. L. ORR, formerly assistant county engineer of Holmes County, Ohio, has been appointed city engineer of Wooster, Ohio.

DR. GEORGE K. BURGESS, new director of the Bureau of Standards, Washington, D. C., has been named by President Harding as chairman of the Federal Specifications Board, succeeding S. W. Stratton, former director of the Bureau.

N. F. HARRIMAN, who has been acting chairman of the Bureau of Standards, Washington, D. C., has been named by the President as vice-chairman and technical secretary of the Federal Specifications Board.

H. C. DICKINSON, who has been on leave of absence from the Bureau of Standards, Washington, D. C., to serve as director of research of the Society of Automotive Engineers, has resumed his work at the Bureau as physicist and has, in addition, been designated as chief of the heat division.

HARLAND BARTHOLOMEW, engineer of the St. Louis City Plan Commission, has been invited to visit Springfield, Mo., to make a survey of the city and offer suggestions for city improvements.

B. J. PARDEE, civil engineer, formerly with the California State Highway Commission and the Associated Pipe Line Co., has been appointed city manager of Visalia, Calif., effective June 1.

OSCAR R. ELTING, who has been a special investigation and maintenance engineer with the Bureau of Water Supply, Akron, Ohio, since 1913, has accepted a position in the Boston office of Barbour and Dixon, consulting engineers.

R. S. LEA, consulting engineer of Montreal, sailed from New York May 12 on a trip to England and the Continent.

IRA MORRISON, for the past eight years city clerk of Chico, Calif., has been appointed city manager under the provisions of a recently adopted charter.

JACOB FELD has left the Turner Construction Co., New York City, to become bridge designer for the Long Island R.R.

GEORGE W. CRAIG, city engineer of Calgary, Alta., has resigned, to take effect May 31. Mr. Craig is a Virginian, was educated in Nebraska and served fourteen years in Omaha as assistant city engineer and as city engineer.

JOHN H. WILSON, consulting engineer, has been appointed city engineer of Duluth, Minn., succeeding E. K. Coe, who has taken up private practice. E. Fuller has been appointed office engineer and R. M. Palmer field engineer at Duluth.

J. P. SCHWADA, engineer of construction for the new Riverside Pumping Station at Milwaukee, Wis., has been appointed city engineer following the resignation of George F. Staal, noted previously in these columns.

H. R. SEWARD, for ten years city engineer of Waco, Texas, has resigned and is now city engineer of Ranger, Eastland County, Texas.

W. E. JOOR and H. M. BIRD have organized the firm of Joor Engineering Co., structural and civil engineers, at 601 Slaughter Bldg., Dallas, Texas.

J. WARREN MYLCHREEST, director of public works of the city of Middletown, Conn., has resigned, effective June 15.

NICHOLAS F. JAHN and VINCENT BRESSI, engineering and highway contractors who have operated in the northern section of the Pacific Coast, have removed their headquarters from Seattle, Wash., to 522 Byrne Bldg., Los Angeles, Calif.

EDGAR A. KINGSLEY has been appointed city engineer of Dallas, Texas, succeeding George D. Faitrace. Mr. Kingsley has been successively city engineer of Little Rock, Ark., state highway engineer of Arkansas, supervising engineer of the Bell County, Texas, highway system, paving engineer of San Antonio, Texas, superintendent of roads for the intermediate section of the lines of the A. E. F. in France, and consulting engineer at San Antonio and Little Rock.

BLACK, MCKENNEY & STEWART, engineers, announce the removal of their offices to 1653 Pennsylvania Ave., N.W., Washington, D. C.

OTTO F. WEISGERBER has resigned as city engineer of Appleton, Wis., and will move at once to California.

GENERAL GEORGE W. GOETHALS, consulting engineer of New York City, has been engaged to make a survey of the water possibilities of the Pike's Peak watershed.

MAJOR A. B. CUTTER, city engineer of Everett, Wash., who is taking a course in business administration in

New York City, has wired his resignation to the Everett city council, and the council has named as his successor Sumner E. Paine. Major Cutter went overseas as lieutenant with the 18th Engineers, later being promoted to the grade of major and assigned to Base Section 6 as section engineer.

R. V. GLENN, consulting engineer for Tarrant County, Texas, at Ft. Worth, in charge of an extensive highway program since 1920, has resigned to become president of the Interstate Rawhide Paving Corp. at Ft. Worth.

Obituary

WALTER V. COHEN, assistant engineer on drainage and sewage disposal in the office of the commissioner of public works, New York City, died April 30, aged 51 years. He had been actively engaged on the preparation of a plan for rebuilding and new construction of sewers for the Borough of Manhattan. From 1906 to 1910 he was engaged on hydraulic and sewer designs for the Drainage Division, Borough of the Bronx and from 1910 to 1912 on the design of the cut-and-cover aqueduct and pressure tunnels for the Catskill Aqueduct. Since 1912 he has been connected with design and construction of the 41st and 46th Streets tunnel relief sewers, the Dyckman St. screening plant, and the Thompson St. automatic pumping station.

PROF. R. CARR-HARRIS, lecturer in civil engineering and architecture at the Royal Military College, Kingston, Ont., and subsequently occupying the same position at Queens University, died May 13 in his eightieth year. He had also done important work in connection with the construction of the Intercolonial and Canadian Pacific Railways.

JOHN H. SCOTT, railroad contractor of Los Angeles, Calif., died recently in Ripley, N. Y., while returning in his automobile to the Pacific Coast from a visit to his old home near Syracuse, N. Y.

JOHN J. HOPPER, civil engineer and register of New York County from 1914-1918, died May 16 in New York City. Mr. Hopper began his career as assistant engineer in planning the street and sewer systems of the Bronx. He contracted for the excavation and erection of the heavy masonry in Columbia University, the building of the elevated structure of the New York Central R.R. from 115th St. to the Harlem River, and the original section of subway from 103rd St. and Broadway under Central Park to 135th St. and Lenox Ave.

JOHN EGAN, pioneer railroad builder, died May 10 at Dixon, Ill. Mr. Egan was chief engineer of the Southern Missouri R.R. and later became general superintendent in charge of construction of the Canadian Pacific, West, at Winnipeg. He also built the Great Northern from Minot, N. D., to Helena, Mont. Later he went to the Hill roads and then to South America as vice-president of the Brazil Ry. Co. Upon his return to this country in 1910 he was president of the Kansas City street railways and light and power company until he retired in 1916.

From the Manufacturer's Point of View

A Point of Contact Between Maker and User of Construction Equipment and Materials

Action on Lumber Standards

Standardization in the lumber industry took a step forward as a result of the meeting of the Consulting Committee on Lumber Standards, held in Chicago, May 14-16. The chief elements of progress were the ratification of basic lumber grades and the establishment, so far as the committee was concerned, of the standard sizes of boards, dimension and finish. The grades recommended by the committee cover the whole range of lumber qualities, divided into two general groups. The first basic group will be known as Select Grades A, B, C and D; and the second basic group will be known as Common, Nos. 1, 2, 3, 4 and 5.

The committee acted favorably upon the recommendation of the Forest Products Laboratory both in the nomenclature of the basic grades and in most of the details of lumber sizes. It was decided that the terms "inch board" and "two inch measurement" be dropped, and in the interests of sound business the term "standard board" and "standard dimension" be adopted and applied to both hardwoods and softwoods. It was decided also that 1⅜-in. S2S (measured at standard commercially dry shipping weight and moisture content for each species) shall be adopted as a minimum thickness of the standard "factory" board, and "box" board, which comprises lumber for remanufacture.

It was recommended that ⅝-in. S1S or S2S (measured at standard commercially dry shipping weight and moisture content for each species) shall be adopted as a minimum thickness of the standard "yard" board, which comprises lumber for general construction and other ordinary purposes, graded on the basis of the use of the piece as a whole. For standard dimension stock not more than 12-in. wide, the size recommended was 1⅜-in. S1S or S2S (measured at standard commercially dry shipping weight and moisture content for each species).

It was agreed that 3⅝, 5⅝, 7½, 9½ and 11½-in. S1E or S2E (measured at standard commercially dry shipping weight and moisture content for each species) be adopted as the standard finished widths of boards, dimension and finish and that consideration be given to the general production of ¼-in. boards when not over 8-in. wide. Commercially dry lumber should not exceed the weights approved by the Central Committee.

Trans-Atlantic Rates Reduced for Heavy Machinery

Based on information from American Commercial Attaché Walter S. Tower, the U. S. Department of Commerce states that recent reductions in trans-Atlantic freight rates on heavy-weight shipments range from 25 per cent on parcels weighing under 2 tons to as much as 7½ per cent on parcels weighing from 7 to 10 tons. The new rates for various weights of shipments, as compared with the old, according to facts supplied by one of the leading operators in the trans-Atlantic service, are indicated in the accompanying table.

TRANS-ATLANTIC FREIGHT RATES ON MACHINERY

Weight (Ton = 2,240 Lb.)	New Rates		Old Rates	
	Per 100 Lb.	Per Cu.Ft.	Per 100 Lb.	Per Cu.Ft.
Under 2 tons	$0.60	$0.30	$0.75	$0.40
Over 2 and not exceeding 3 tons	.74	.37½	1.05	.55
Over 3 and not exceeding 4 tons	.78	.40	1.25	.65
Over 4 and not exceeding 5 tons	.83	.42½	1.45	.75
Over 5 and not exceeding 6 tons	.91	.47½	1.65	.85
Over 6 and not exceeding 7 tons	1.00	.52½	2.15	1.10
Over 7 and not exceeding 10 tons	1.10	.57½	2.65	1.35
Over 10 and not exceeding 15 tons	1.14	.60		
Over 15 tons	(1)	(1)	(1)	(1)

[1] Specially contracted for.

Note—All these rates are applicable to weight or measurement, at ship's option.

Balance of Trade Against U. S. for First Time Since 1914

For the first time since 1914 the balance of foreign trade in imports and exports of merchandise turned against the United States in March when, according to figures just issued by the U. S. Department of Commerce, imports totaled $402,000,000 as against exports of $341,162,349, an excess of imports over exports of nearly $61,000,000. This excess is the largest for any one month in the country's history.

For the first four months of 1923, figures of the Department of Commerce show, merchandise exports were $1,324,773,214, as compared with imports of about $1,375,000,000, or a trade balance against the United States of about $50,000,000, compared with a balance in our favor of about $272,000,000 in the same period of 1922 and of about $938,000,000 in the same period in 1921. For April it is estimated that the balance between imports and exports will be about even.

The import movement, according to Dr. Julius Klein, of the Commerce Department, appears to have been largely made up of raw materials brought into the United States for manufacture. Rising prices in this country are said to have discouraged exportation.

Trenching Machine Types for Various Kinds of Work

Advice to users of trenching machines, with particular reference to the selection of the proper type for the character of work planned, is contained in a recent memorandum sent out by the Pawling & Harnischfeger Co., Milwaukee. "If you do a lot of shallow

trenching," the memorandum states, "use the wheel type machine and dig the trench in any soil up to 7½ ft. deep and 28 in. wide at one cut. For deep trenching use the ladder type machine, which digs to 18 ft. deep and 42 in. wide. For a greater width than 42 in. the dragline has proved to be the most practical trench excavator."

Business Notes

HENRY WOODLAND, secretary and treasurer of the Allis-Chalmers Manufacturing Co., Milwaukee, died suddenly May 14. He was a native of Utica, N. Y., and before joining the Allis-Chalmers organization served with the New York Air Brake Co. and as treasurer of the Gates Iron Works, Chicago, which was consolidated with the Allis-Chalmers organization in 1901.

WESTINGHOUSE ELECTRIC & MANUFACTURING Co. East Pittsburg, Pa., for the year ending March 31, 1923, has reported a net income of $12,263,485. Dividend requirements were $6,033,428, so that over twice this amount was earned and more than $6,000,000 added to the surplus. Gross sales for the year were $125,000,000 which represents an increase of $25,000,000 oves the sales of last year. Current assets total over $106,000,000, and current liabilities less than $17,000,000.

The BLACKWOOD ELECTRIC STEEL CORP., Parkersburg, W. Va., will soon erect in that city a modern electric steel foundry. The design and supervision of the plant is being handled by Mills, Rhines, Bellman & Nordhoff, engineers, Toledo, Ohio. The structural steel contract has been placed and the remainder of the material will be contracted for soon, so that the plant can be constructed immediately and put in operation in the early spring.

CLARK R. MANDIGO, formerly assistant city engineer, Kansas City, Mo., has resigned his position as chief engineer for the Western Paving Brick Manufacturers Association, to accept the position of engineer and secretary for the Kansas Association for Public Improvements. The latter association was recently formed with a membership of contractors doing all classes of public works in the State of Kansas. Offices have been opened at 616 Dwight Building, Kansas City, Mo.

LAYNE & BOWLER Co., water supply contractors, Memphis, Tenn., has recently organized associate companies in New York, Chicago, Stuttgart, Ark., St. Petersburg, Fla., and Memphis, Tenn. Under the new arrangement men and equipment can be supplied more promptly than when all business was handled directly by the parent company. The associate companies are complete within themselves, each having its own officers, men and equipment. The officers are all former Layne & Bowler men who have been with the company for periods of from six to thirty years.

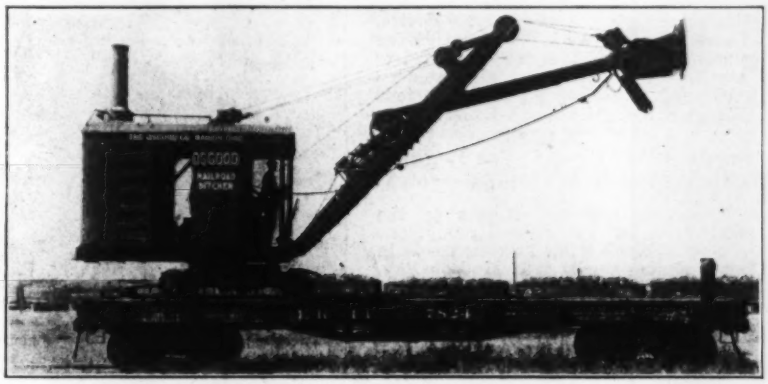
MARQUETTE CEMENT MANUFACTURING Co., Chicago, has purchased the plant, stock and good will of the Cape Girardeau Portland Cement Co., Cape Girardeau, Mo.

Equipment and Materials

Improvements Made in Revolving Type Railroad Ditcher Shovel

Increased efficiency and lower maintenance costs have been sought through improvements that the Osgood Co., Marion, Ohio, has made during the past year in its heavy-duty revolving type railroad ditcher shovel of ¾ and 1 cu.yd. capacity.

The main body has been redesigned to increase strength with only slight additional weight and has fitting surfaces machined to insure interchangeability



of truck frames, thus making it possible to mount the same machine on railroad trucks of either standard or special gage, traction or continuous tread trucks. This feature, it is claimed, is a great saver in mechanical outlay as the same machine can be put on different mountings and used for cleaning ballast, laying rail, ditching right-of-way, unloading, loading, or stocking coal, as a locomotive crane and many other uses where a machine of extreme mobility is required.

The machines are designed for ready conversion to steam shovel, crane, single-line clamshell or dragline outfit. The auxiliary hoisting drum is sufficiently strong to operate a clamshell or dragline bucket with a single line, eliminating a set of sheaves on the bucket, reducing wear and tear on the line as well as speeding up operation. All points of great stress are reinforced to withstand excessive wear and strain. Important shaftings are oversize to insure ample strength.

Features of Cleveland's New Pumping Equipment

New developments made in apparatus for water-works plants by the De Laval Steam Turbine Co., Trenton, N. J., relate to higher duties, increased capacities in single units, utilization of very high steam pressures and superheats, and improved heat balance and utilization of steam. A departure from previous water-works practice in all of these respects is represented, the company states, by the equipment of the new Fairmount Station, Cleveland, which is to pump filtered water from the Baldwin reservoir into the city mains. Steam at 300 lb. pressure and 200 deg. F. superheat is supplied to five De Laval geared-turbine-driven centrifugal pumps, three of which are designed to deliver 20,000,000 gal. per day each against 450 ft. maximum head, and two to deliver 20,000,000 gal. per day each against 154 ft. maximum head. The fuel cost chargeable against pumping, it is predicted, will be exceptionally low, due to the fact that large quantities of steam are to be bled from some of the turbines at 125 lb. pressure for the heating of a hospital and other city establishments, while from others steam is bled at 10 lb. for heating the pumping station and close-by municipal buildings.

A novel feature is the use of water turbines for driving the condensate pumps and the stokers. These small water turbines, which are of the reaction type, receive water from the discharge of the raw-water low head pumps under a head of 95 ft., and discharge against 25 ft. pressure, realizing a net head of 70 ft. The stoker turbines are rated at 10 hp. each, and drive the stokers through worm gears. Because of the small powers, the overall efficiency of water turbine drive is stated to be better than that of small steam turbine drive.

Test Corrugated Culvert Pipe at Railway Exhibit

Loading a 30-in. culvert of No. 12 gage corrugated metal by means of two 100-ton hydraulic jacks, in the exhibit of the Armco Culvert and Flume Manufacturers Association at the recent Railway Appliances Exhibition in Chicago, is said to have shown a slight deflection when the load reached 110 tons, but no further movement under

frequent applications of 120 tons. The culvert was bedded in coarse wet sand about 12 in. deep above and below it, the sand being retained by planking against the structural steel posts which carried cross girders for the reaction bearing of the jacks. On the sand were three ties spaced 18 in. on centers and supporting two 12-in. channels (instead of rails) 4 ft. 8½ in. apart. Each jack rested on a channel and its reaction was taken by an overhead steel frame, as shown in the accompanying illustration.

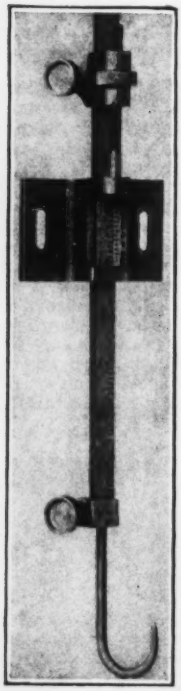
Apparatus for measuring the deflecton consisted of three 2-in. cylinders supported independently of the culvert and having plungers bolted to the crown of the pipe. Flexible tubing connected the cylinders with three ½-in. glass gages 6 ft. high, containing a colored liquid, any movement of the crown being magnified sixteen times by this device. These cylinders were placed inside the pipe middle and ends. It is planned to use this apparatus for an extended series of tests on pipes of various diameters and thickness.

Small Pump Used to Ice Logging Roads in Canada

Indicating the varied uses of the small Evinrude centrifugal pump, one is now at work icing logging roads in the Canadian woods near Hudson Bay. The pump is slung down a water hole and lifted up to drain to prevent freezing.

Hook Gage Improved

Based on experience in the field of hydraulic measurement W. & L. E. Gurley, Troy, N. Y., have devised certain refinements which make their hook gage more convenient for the user. The improvement has been in eliminating, as far as possible, the possibility of inaccurate reading through absence of good light or other troublesome conditions.

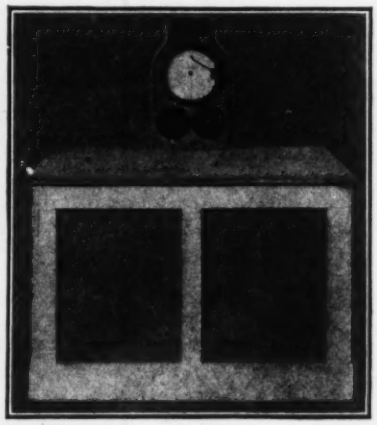


The new Gurley hook gage is graduated on a square tube. The change from the usual round tube overcomes the possibility of its turning in the bracket, a happening which often turned the graduated side of a round tube out of line with the vernier. At the same time the new construction brings the reading face flush with the vernier so that there is no shadow to handicap an accurate observation. The clamp nuts have been changed slightly to give a little extra clearance between the knurled heads and the wall on which the gage is mounted. In addition, the clamps have been made larger and more positive, as well as easier to get at.

The adjusting screw has been brought over into line with the graduated scale of the gage so that its vertical movement can be accomplished more easily and a fine setting arrived at with a minimum of effort. The hook and its rod are still of a round section and so arranged that the rod can be extended as necessary to get the right height and rotated so that the tip of the hook breaks the surface where light reflection is the best.

New Rate Controllers for Detroit Filtration Plant

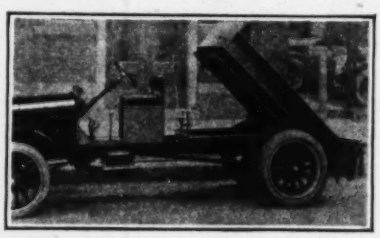
At the new filtration plant in Detroit, which will be inspected during the annual convention of the American Water Works Association this week, the



Builders Iron Foundry, Providence, R. I., is installing 80 Venturi rate controllers of special design. As indicated in the accompanying photograph of the operating table, the controller gage has four dials. The upper one is a totalling dial for integrating the amount of water flow from the filter. The middle dial records on a 12-in. chart the rate of flow. The two lower dials indicate loss of head and the instantaneous rate of flow from the filter. The controller gages are operated by mercury levels.

Self-Dumping Steel Body Designed for Ford Trucks

The Wood Hydraulic Hoist and Body Co., Detroit, is building for use on the Ford truck a self-dumping steel body unit of the same general design as the bodies which the company has supplied for heavier trucks. The body, with its mounting frame, hinges and locking de-



vice, is a complete unit ready for bolting on the truck frame. There are no holes to drill or parts which are attached separately.

The hinges on which the body tilts embodies two pins or fulcrums which have a definite effect of displacing the center of the loaded body towards the rear while dumping, assuring quick action and obtaining a high dumping angle. The body is returned to the down and locked position by a handle attached to the front of the body, only a slight effort is required as the body when empty is in a balanced condition. The releasing handle is arranged for convenient operation by the driver and positively locks the body against accidental operation.

The tail gate opens and closes automatically, requiring no attention from the driver.

Publications from the Construction Industry

Electric Hoists and Overhead Cranes—LINK-BELT CO., Chicago, has just issued a new book on electric hoists and overhead cranes, illustrated with photographs showing recent adaptations of this equipment in widely divergent fields. For instance, the practice of a sewer contractor in Maryland who used a hoist for removing dirt, and the methods employed at a shipbuilding plant in Texas, which adopted the same scheme for moving and placing timbers, are covered in the new publication.

Heating and Ventilating Equipment—BISHOP & BABCOCK CO., Cleveland, in a 278-p. illustrated handbook describe a complete line of heating specialties and ventilating equipment, including traps, thermograde auto-valves, pressure-regulating valves, damper regulators, vacuum pumps, governors, squirrel cage, propeller and steel-plate fans. There is a considerable amount of heating and ventilating data included in the book in the form of tables, curves and sketches of typical industrial layouts.

Light Excavator—BAY CITY DREDGE WORKS, Bay City, Mich., in a 40-p. illustrated catalog, features its one-man excavators for sand, gravel, ditching, and road work. These excavators may be operated either with dipper or clamshell attachments of about ½-yd. capacity. The equipment is operated by a gasoline engine and weighs 18,000 lb. The outfit also may be operated with a skimmer scoop or as a land dredge with various types of mounting.

Air Valves—MULTIPLEX MANUFACTURING CO., Berwick., Pa., in a 35-p. illustrated booklet, features the Crispin air valve to prevent the collapse of pipe lines. The valves are of a type which automatically permit the escape of air while the line is being filled and the entry of air while it is being emptied. The limit of size on a single valve is 4 in. Where larger openings are desired clusters of two or four are placed on a single assembling casting.

Non-Metallic Gears—WESTINGHOUSE ELECTRIC & MANUFACTURING CO., East Pittsburgh, Pa., in a 20-p. illustrated booklet, describes the advantages of its non-metallic Micarta gears and pinions. Noiselessness and durability are among the chief advantages claimed. The base material in these gears is a fabric woven to a definite weight of thickness and especially treated to condition it for impregnation with a binder. After the binder has been absorbed the processes are carried to their final stage when heat and pressure are applied.

Business Side of Construction

FACTS AND EVENTS THAT AFFECT COST AND VOLUME

Bricklayers' Strike Called on New York Building

Demand Raise in Basic Wage From $10 to $12 a Day—Many Important Structures Affected

A STRIKE of bricklayers working for members of the Mason Builders' Association on a number of important building operations in New York City went into effect May 21 and involved from 1,500 to 2,000 workers. The issue is the demand of the union men for a raise in the basic wage from $10 to $12 a day. It is estimated that structures involving an aggregate cost of over $100,000,000 are affected by the strike which involves operations now in progress by a number of the large building construction companies, including the George A. Fuller Co., the Thompson-Starrett Co., Marc Eidlitz & Son, the James Stewart Co., Cauldwell & Wingate, T. A. Zimmerman, Inc., and others. A shutdown of work by the bricklayers, if it continues, will affect other building trades including plumbers, carpenters, sheet metal workers, plasterers and painters.

Some of the important New York buildings affected by this week's strike are the Federal Reserve Bank, the new store on Fifth Ave. of Saks & Co., the nineteen-story annex of R. H. Macy & Co., buildings of the New York Telephone Co., the Greenwich Bank, the Cotton Exchange, and a number of large apartment houses.

Frank E. Conover, president of the Mason Builders' Association, has stated that the strike was called "ostensibly to secure a basic wage of $12," but that its "real purpose is not the amount of money; it is the attempt to establish the $12-day as the standard basic rate for a period of two years, making the peak wage permanent."

February Wages for Common Road Labor Same as 1922

Wages of common labor for road work in February were practically the same as for the same month of 1922, according to the Bureau of Public Roads, U. S. Department of Agriculture. Averaged for groups of States the price per hour was as follows: New England, 48c.; Middle Atlantic, 40c.; East North Central, 34c.; West North Central, 29c.; South Atlantic, 21c.; East South Central, 19c.; West South Central, 24c.; Mountain, 38c.; and Pacific, 47c. In some of these sections the figures are based on a small amount of work due to the season of the year.

The price per hour for other classes was as follows: Superintendents, 79c. to $1.11; foremen, 53 to 88c.; truck drivers, 27 to 64c.; roller engineers, 35 to 81c.; mixer operators, 31 to 98c.; steam-shovel operators, 65c. to $1.19; carpenters, 43 to 76c.; concrete finishers, 35 to 78c.; mechanics, 30 to 61c.; teams without drivers, 24 to 80c.; and teams with drivers, 29c. to $1.12. In almost every case the upper limit of price prevails on the Pacific slope.

Steel-Castings Bookings Decline

A decline of almost 40 per cent from the March high record occurred in the April bookings of commercial steel castings, according to reports received by the Department of Commerce through the Bureau of the Census, in co-operation with the Steel Founders Society from companies comprising over two-thirds of the commercial castings capacity of the United States. Total bookings reported in April amounted to 90,968 tons or at the rate of 93.9 per cent of shop capacity as against 148.2 per cent of capacity shown by March bookings.

The following table shows the bookings of commercial steel castings for the past four months by 65 identical companies, with a monthly capacity of 96,900 tons, of which 38,300 tons are usually devoted to railway specialties and 58,600 tons to miscellaneous castings.

BOOKINGS OF COMMERCIAL STEEL CASTINGS

Month 1923	Total — Net Tons	Total — Per Cent of Capacity	Railway Specialties — Net Tons	Railway Specialties — Per Cent of Capacity	Miscellaneous Castings — Net Tons	Miscellaneous Castings — Per Cent of Capacity
January	100,605	103.8	47,879	125.0	52,726	90.0
February	90,152	93.0	39,845	104.0	50,307	85.8
March	143,564	148.2	76,409	199.5	67,155	114.6
April	90,968	93.9	39,610	103.4	51,358	87.6

Lumber Movement Decreases

Following several weeks of declining volume of new business the sawmills reporting to the National Lumber Manufacturers Association recorded a decrease of about 25,000,000 ft. in orders for the first week in May, as compared with the preceding week, due in part to fewer mills reporting. Shipments fell off by 32,000,000 ft. and production by 26,000,000 ft. Taken in connection with the fact that as compared with the same week of 1922 new business again shows a decrease, the question is raised in some quarters as to whether the so-called builders' and buyers' strike against increasing labor costs has not temporarily checked the building movement. Shipments are slightly larger than at this time last year and production is much larger. In consequence of the emphasis that has been placed on ample production and facilitated shipments, accumulated orders for 1923 to date are less than 600,000,000 ft. in excess of production and less than 200,000,000 ft. more than shipments.

Railways Report New Freight Cars

According to the Car Service Division of the American Railway Association, new freight cars installed by the carriers from Jan. 1 to April 15, 1923, totaled 44,302, while 1,077 new locomotives were placed in service during the same period. Of the new freight cars installed, 19,867 were box cars, 17,096 were coal cars and 1,299 were stock cars.

Federal-Aid Road Costs Not Higher Than Others

Washington Correspondence

Costs of highway construction on federal-aid projects compare favorably with those on roads constructed by states, counties or municipalities, the U. S. Bureau of Public Roads' figures show. The claim has been made that the demands of federal inspectors are such that contractors submit higher bids on federal-aid work. In some instances it has been claimed that the full benefit of federal aid to communities thus is lost. A survey of figures in possession of the Bureau of Public Roads shows that that is not the case. Comparisons which are fairly typical of the average situation are as follows:

Average cost of pavement on nine Virginia federal-aid projects, $2.95 per square yard; average figures on four comparable state or county projects, $2.99 per square yard. Class A concrete on 48 Virginia federal-aid projects averaged $25.33 per cubic yard; the average cost of 20 comparable state and county projects was $25.42 per cubic yard. The average cost of concrete paving on 24 Iowa federal-aid projects was $4 per square yard, whereas the average on four comparable county or state projects was $4.16.

Rock excavation on ten federal-aid projects in Oregon was done for $1.76 per cubic yard. The average cost on 52 state and county rock excavation projects was $1.67 per cubic yard. The average cost of Class A concrete on nine Oregon projects was $29.33, whereas the average paid for that type of pavement on 69 state and county projects was $29.15. In Rhode Island, the average cost of ledged rock excavation on seven projects was $4.42. On a similar number of comparable state projects it was necessary to pay $3.73. In the same state, the respective figures for gravel foundation were $2.26 and $2.30.

New York High Court Upholds Dwelling Tax Exemption

The Court of Appeals at Albany, N. Y., has upheld the constitutionality of the state law which exempts new dwellings from taxation for ten years after April 1, 1923. The court affirmed the opinion of the Apellate Division, First Department, which reversed the decision recently made by John M. Tierney, justice of the State Supreme Court, to the effect that the exemption of dwellings was unconstitutional (see *Engineering News-Record*, March 29, 1923.)

Large Contracts Let During Week

Among the week's announcements of contracts awarded in Construction News, pp. 303 to 407, are the following large projects:

Grain elevators, Bulgaria, to MacDonald Engineering Co., Chicago, Ill., $10,000,000.

Rebuilding and repairing railway tracks, West Toronto, Ontario, by day labor, $2,500,000.

Apartment, Washington, D. C., to Weller Constr. Co., $2,000,000.

Apartment, Brooklyn, N. Y., to G. M. Seglin, New York City, $2,000,000.

Bids Wanted on Big Jobs

Among the projects on which bids are either asked or will soon be called for, in Construction News, pp. 303 to 407, are the following:

Four 20,000 kw. turbo units for power plant, Detroit, Mich., for Public Lighting Commission, $1,247,000.

Hotel, Jamestown, N. Y., for Hotel Jamestown, Inc., $1,225,000.

McGovern Subway Bid Low

Unofficial figures indicate that for the construction of the Broadway-Fourth Ave. subway, New York, for which bids were opened by the Transit Commission May 22 Patrick McGovern, Inc., New York, was low with a total of $5,995,000.

Weekly Construction Market

THIS limited price list is published weekly for the purpose of giving current prices on the principal construction materials, and of noting important price changes on the less important materials. Moreover, only the chief cities are quoted. Valuable suggestions on costs of work can be had by noting actual biddings as reported in our Construction News section. The first issue of each month carries complete quotations for all construction materials and for the important cities. The last complete list will be found in the issue of May 3; the next, on June 7.

Steel Products:	New York	Atlanta	Dallas	Chicago	Minneapolis	Denver	San Francisco	Seattle	Montreal
Structural shapes, 100 lb	$3.64	$4.30	$4.50	$3.40	$3.55	$4 20	$3.85	$4.10	$3.75
Structural rivets, 100 lb	4.40	5.00	5.25	3.75	4.25	5.15	5.00	4.75	6.00
Reinforcing bars, ¾ in. up, 100 lb	3.54	4.25	+3 70	3.32½	3.45	3.85	3.65	4.10	3.50
Steel pipe, black, 2½ to 6 in. lap, discount	49%	50%	45%	59½%	53-5%	36%	35.2@47.6%	40%	32.76
Cast-iron pipe, 6 in. and over, ton	+62.50@63.50	—55.00	63.00	60.20	60.50	69.00	60.00	70.00	60.00
Concreting Material:									
Cement without bags, bbl	2.70@2.80	—2.80	2.25	2.20	2.39	2.85	2.71	2.90	2.68
Gravel, ¾ in., cu.yd	2.25	1.90	2.25	2.00	1.75	1.90	2.15	1.25	1.50
Sand, cu.yd	1.25	1.24	+1.95	2.00	1.00	1.00	1.50	1.25	1.25
Crushed stone, ¾ in., cu.yd	1.75	2.00	2.50	2.00	2.25	3.50	2.15	3.00	1.90
Miscellaneous:									
Pine, 3x12 to 12x12, 20 ft. and under, M.ft	65.00	42.00	53.00	60.00	—45.75	44.00	41.00	31.00	90.00
Lime, finishing, hydrated, ton	18.60	23.50	22.50	20.00	25.50	24.00	22.00	24.00	21.00
Lime common, lump, per bbl	3.00@3.25	1 50	2.50	1.50	1.50	2.70	1.75	2.80	11.00
Common brick, delivered, 1,000	23.50	14.00	13.10	11.00	17@19	12.00	15.00	13.00	16.50
Hollow building tile, 4x12x12, per block	Not used	.0893	.115	.1032	0836	.065	....	.11	.115
Hollow partition tile 4x12x12, per block	.1573	.0893	.115	....	....	.065	.108	.11	....
Linseed oil, raw, 5 bbl. lots, gal	1.16	—1.24	—1.35	+1.37	1.29	1.39	1.24	.86	1.38
Common Labor:									
Common labor, union, hour	.75	.35	.....	.....	.....	.50@.55	.56½	....	.....
Common labor, non-union, hour	.....	.30	.30@.50	.72½	.35@.50	.35@.50	.50	.50@.62½	.30

Explanation of Prices—Prices are to contractors in carload lots unless other quantities are specified. Increases or decreases from previous quotations are indicated by + or — signs. For steel pipe, the prevailing discount from list price is given: 45-5% means a discount of 45 and 5 per cent. Charge is 15c. per 100 lb. for cutting reinforced steel into 2-ft. lengths or over.

New York quotations delivered, except sand, gravel and crushed stone, alongside dock; common lump lime, in 280-lb. bbl. net, and hydrated lime f.o.b. cars; tile "on trucks"; linseed oil and cast-iron pipe f.o.b. Labor—Concrete laborers' rate, 81½c.; building laborers, 75c.; minimum for pick and shovel men, 50c. per hr.

Chicago quotes hydrated lime in 50-lb. bags; common lump lime per 180-lb. net. Lumber delivered on job.

Minneapolis quotes on fir instead of pine. Brick, sand and hollow tile delivered. Cement on cars. Gravel and crushed stone quoted at pit. We quote on brown lime per 180-lb. net; white is $1.80 for Kelly Island and $1.70 for Sheboygan. Common labor not organized.

Denver quotes on fir instead of pine. Cement "on tracks"; gravel and sand at pit; stone on cars; lime, brick, hollow tile and lumber on job. Tile price is at warehouse. Linseed oil, delivered, in iron bbl. Common lump lime per 180-lb. net.

Atlanta quotes sand, stone and gravel per ton instead of cu.yd. Common lump lime per 180-lb. net.

Dallas quotes lime per 180-lb. bbl. Steel, cement, cast-iron pipe and crushed stone f.o.b. cars, other materials delivered.

San Francisco quotes on Heath tile, size 5½ x 8 x 11½. Prices are all f.o.b. warehouses except C. I. pipe, which is mill price plus freight to railway depot at any terminal. Common lump lime per 180-lb. net. Lumber prices are to dealers in yards at San Francisco, for No. 1 fir common.

Seattle quotes on Douglas fir (delivered) instead of pine. Lump finishing lime per 180-lb. net. Hollow building tile delivered. Hydrated lime in paper sacks. Sand and gravel at bunkers.

Montreal quotes on pine lumber. Sand, stone, gravel and lump lime per ton. Cement, lime and tile are delivered; sand, gravel and stone on siding; brick f.o.b. plant; steel and pipe at warehouse. Hollow tile per ft. Cement price is in Canadian funds (the Canadian dollar stands at 97.91). Bag charge is 80c. per bbl. Discount of 10c. per bbl. for payment within 20 days from date of shipment. Steel pipe per 100 ft. net; 2½-in., $32.76; 6-in., $108.

Changes Since Last Week

Mill quotations on steel structures now $2.50 per 100 lb. for third quarter deliveries; $2.60 demanded for small shipments in the current quarter. Bars, however, quoted as low as $2.40, f.o.b. Pittsburgh, for delivery in third quarter. Bulk of structural buying is at the $2.50 base. The postponement of building projects has had the effect of diminishing the volume of new business at mills. No tendency, however, has yet been shown, on the part of buyers, to hold up shipments on orders already placed. Considerable material is already booked for delivery in the current quarter.

An advance of 20c. per 100 lb. is reported on steel bars in Dallas, together with a rise of 5c. per cu.yd. in sand, due to higher labor costs. Both Atlanta and Dallas report declines of 2c. per gal. in linseed oil, due to improvement in seed supply; Chicago, however, quotes advance of 2c. per gal. Atlanta reports drop of $1 per ton in cast iron pipe and 5c. per bbl. in cement, during week; Minneapolis quotes decline of $1 per M. ft. in Douglas fir timbers. No other important price changes reported during the week.

Conditions in the New York building trades may be outlined briefly, as follows: Possibility of general strike, June 1, lessened by decision on the part of unions to let each craft negotiate separately with employers; calling strikes only in those trades where advance of $1 per day is refused.

Stone carvers on strike for wage advance from $10.50 to $12.50 per day.

About 2,000 bricklayers on strike on jobs covered by the Mason Builders' Association. Unions demand contract with employers for $12 per day for two years. Employers offer contract with bricklayers granting $10 per day until the end of 1926, with bonus of $2 per day for the rest of the current year.

Brick yard laborers in the Raritan River district on strike, demanding advance from $3.05@$3.70 per day to $3.50@$4.25.

General strike of painters averted. Wage scale advanced to $10 per day, from $9. Five-day week as well as other demands affecting health of operators, granted by employers.